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YELLOWSTONE – TONGUE A.P.O.

WATER QUALITY MANAGEMENT PLAN

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WATER QUALITY MANAGEMENT PLAN
for

CARTER COUNTY
CUSTER COUNTY
FALLON COUNTY
NORTHERN CHEYENNE INDIAN RESERVATION
POWDER RIVER COUNTY
ROSEBUD COUNTY
TREASURE COUNTY

PREPARED BY
YELLOWSTONE-TONGUE AREAWIDE PLANNING ORGANIZATION

TECHNICAL ASSISTANCE PROVIDED
BY

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MARCH 1978

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(These materials were developed by the YTAPO or by consultants on contract to the YTAPO. Information taken from these reports has been utilized in the development of this PLAN.)

1. Northern Cheyenne Report

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    b. Description of project area
    c. Probable industrial and agricultural growth
    d. Population projections
    e. Coordination with other programs

3. Water Quality Data

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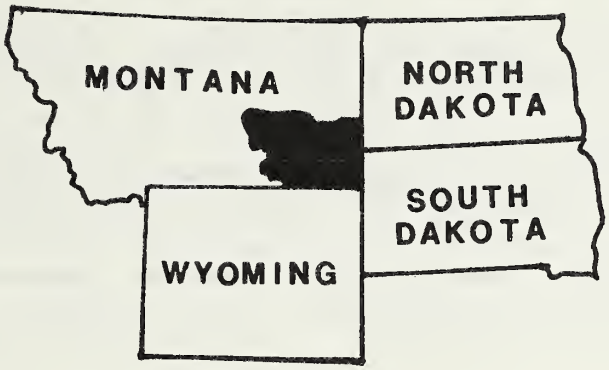
   g. Legal Review

SUMMARY

The Yellowstone-Tongue APO (YTAPO) includes six counties (Carter, Custer, Fallon, Powder River, Rosebud, and Treasure) and the Northern



Cheyenne Indian Reservation in Southeastern Montana. Most of the citizens live in a relatively rural environment. If the largest community is not included, the population density is approximately one person per square mile.

The dominant land use is grazing. The river valleys support large acreages of irrigated agriculture, primarily hay crops along the Tongue and Powder River and an assortment of crops including corn, beets, and beans along the Yellowstone River. Portions of the Powder River and Carter Counties have commercially harvestable forest.

There are no large scale manufacturing plants within the project area. The primary industries other than agriculture are construction and coal extraction and conversion.

Construction activities take place throughout the area. Coal is being extracted from two large mine sites within the project area and two immediately adjacent to it. There are two fossil fuel-fired power plants at Colstrip, Montana; it is anticipated that at least two more will be constructed at that site providing a total generating capacity of over 2,000 megawatts. Continuous rumors of the construction of additional fossil fire generation plants and coal gasification plants abound.

Many groups have attempted to project the development of the area. These projections of economic expansion and population increase are often quite divergent. The YTAPO has taken the position that due to a lack of knowledge of future federal energy policy and an incapability to predict advances of technology,

predicting economic and population changes is a rather futile process. The YTAPO's attempts to project have been confined to summarizing and, in some cases, interpreting data presented by other groups. Some data is presented in Table 1.

Virtually all the projections made for the project area indicate major expansions of industrial facilities and population. However, each set of projections seems to become obsolete quite rapidly. Around 1970 a well known study anticipated the rapid development of large fossil fuel-fired power generation plants. Approximately three years later another group made a series of projections. At this time the dominant factor was coal gasification. About two years after that projection, the consensus appeared to be that the coal would be exported instead of converted on site. As of 1977, the expectation of exporting coal instead of on-site-conversion still appears to dominate the projections of growth. But there are still rumors of on-site coal gasification. Also, there is controversy as to whether or not coal should be exported by slurry pipeline.

Table 1: POPULATION DATA FOR COUNTIES AND INCORPORATED TOWNS

COUNTY OR TOWN	1940 Census	1950 Census	1960 Census	1970 Census	Projections based on historic trend 1980	Projections based on historic trend 1990	YTAPO Estimate of Probable Range 1981	YTAPO Estimate of Probable Range 1996
CARTE	3,280	2,798	2,493	1,956	1,515	1,074	1600-2400	1200-3000
CUSTER	10,422	12,661	13,227	12,174	12,758	13,342	11000-15000	10000-20000
FALLON	3,719	3,660	3,997	4,050	4,160	4,270	4000-5000	3500-5500
POWDER RIVER	3,159	2,693	2,485	2,362* / 2,862	2,069* / 2,763	1,830* / 2,664	2200-3500	2100-6000
ROSEBUD	6,477	6,570	6,187	6,032 / 9,578†	5,884	5,736	8000-12000	8000-15000
TREASURE	1,499	1,402	1,345	1,069 / 1,200†	926	783	1100-1600	100-3000
BAKER	1,304	1,772	2,365	2,584	3,011	3,438	2500-3500	2500-4000
BROADUS	——	517	628	679● / 799	733● / 940	787● / 1,081	800-2000	700-4000
EKALAKA	719	904	738	663	644	625	600-750	500-1000
FORSYTH	1,696	1,906	2,032	1,856 / 2,449†	1,909	1,962	2500-4500	2500-6000
ISMAY	176	182	59	40	30■	20■	30-50	20-50
HYSHAM	392	410	494	373 / 600	367	361	600-1000	450-2000
MILES CITY	7,313	9,243	9,665Δ	9,023	9,593	10,163	9000-12000	8000-18000
PLEVNA	291	247	263	189	155	121	150-300	100-300

* Census shows 2,862, conservative assumption of 500 oil field transients gives 2,362.
† 1975 or 1976 census data
● Census shows 799, conservative assumption of 120 oil field transients gives 679.
■ Estimated not calculated
Δ Annexed 37 people

WATER QUALITY

Water quality varies noticeably throughout the project area. Table 2 summarizes the water quality of the major streams.

Table 2

RIVER	SALINITY	BACTERIA	SEDIMENT	OXYGEN DEMAND
Yellowstone River	Low	Low	Moderate	Low
Tongue River	Moderate	Low	Moderate	Low
Powder River	High	Low	High	Low

Most of the water quality data used by the YTAPO was taken by the U. S. Geological Survey. Water quality measurements are common near the coal fields. However, outside the coal fields there are a number of drainages of 500 to 1,000 square miles with only a few water quality samples. Several smaller drainages have not been sampled.

Most of the streams in the project area carry a high sediment load and are rather saline compared to those located in other parts of the country. Bacteria levels are usually very low and the dissolved oxygen levels are usually well above the 5 parts per million level usually considered as minimal for fish.

The Tongue and Yellowstone Rivers are considered to be fishable rivers. Most of the streams east of the Tongue River, including the Powder River, are not considered to be fishable. However, many people do fish them. Catfish of five to ten pounds are common in the Powder River and its tributaries.

Fishing, boating, and related recreational uses are common on the Yellowstone River but limited on the other rivers and streams. The Powder and Tongue Rivers and many of the smaller streams, including backwaters and drainage ditches, are utilized for informal recreation by the younger residents of the area.

With a few very noticable exceptions adjacent to urbanized areas, the recreational use of the waters is not restricted by man-induced point source materials. Natural water quality factors which may be occasionally aggravated by man pose severe restrictions on the use of much of the water in the area. The high sediment and dissolved loads, especially in the areas east of the Tongue River and north of the Yellowstone River, restrict use for recreational and agricultural purposes.

The bacteriological quality of the water of the major rivers is good. Wastewater discharges to these rivers should be limited in order to maintain this existing high quality.

The physical and chemical quality of the waters and streams, with the exception of the Yellowstone and Tongue Rivers, is poor. Even though the wastewater discharged to these streams receives secondary treatment, the salinity, suspended sediment, and in some cases sodium levels are excessive. These materials are primarily the result of natural nonpoint sources which are not amendable to conventional control practices. The adoption of improved construction and farming techniques will help alleviate the problem. However, natural geological factors will continue to cause elevated salinity and sediment levels.

Sediment was considered the major water quality problem when the project was started. But over the last two years the staff has reached a consensus that salinity is more critical. Sediment can be removed by simple mechanical or physiochemical treatment processes. Salinity removal is very expensive.

While not presently a significant problem, dewatering of streams and depletion of groundwater systems may have a major impact in the future. In surface water systems, dewatering aggravates the already marginal salinities and severely affects fisheries and the suitability of the water for irrigation. The Draft EIS on the Yellowstone River Basin published by the Department of Natural Resources and Conservation states, "*However, even at the low projected level of development, the quality of the water (Powder River) would be unacceptable for irrigation at least one year out of two.*" In groundwater systems where there is limited recharge and slow water movement, dewatering is really the depletion of a natural resource.

Groundwater quality is quite variable throughout the project area. Generally, the area is characterized by high sodium, sulfate, and bicarbonate levels. A few of the deeper wells show excessive flouride concentrations. Most of the groundwater is very soft and in some instances the sodium levels may be detrimental to human health. Sodium levels also limit the use of the water for irrigation. Selected groundwater quality samples are given in Table 3.

Table 3: Selected Groundwater Quality Samples, With Data On The Tongue River Given For Comparison Purposes

	Depth feet	SAR	TOTAL DISSOLVED SOLIDS ppm	HARDNESS ppm	IRON ppm	FLOURIDE ppm	SULFATE ppm
Shallow, river bottom wells	25	3.1	934	470	6.0	.4	302
	18	5.8	1,710	646	-	.8	825
Fort Union Formation Wells	192	3.3	1,360	745	25.4	.5	413
	210	40	635	9	0	2.2	1.5
	140	21	4,090	610	.2	.4	2200
Hell Creek Formation Wells	850	20	762	44	.1	1.4	107
	371	65	780	5	0	2.2	16
Tongue River at Miles City		1.4	555	325	.05	.4	225

POINT SOURCES

Point sources, as defined in this report, imply any source which will require a permit under the existing state or federal regulations. They include most industries or municipalities which discharge wastewater to a stream or river via a distinct pipe or ditch.

As of June 1977, there were 10 municipal and 21 industrial discharge permits within the project area. Eighteen of the industrial permits will not be renewed next year, as Gary Operating will be converting their facilities to zero discharge units. A few additional facilities may be required to obtain permits, since the YTAPO has located several questionable discharges which currently do not have permits.

The permit system within the project area is complicated because the sources of wastewater on the Northern Cheyenne Indian Reservation come under the federal permit system, not the state system.

Urban storm water discharges also require discharge permits. The state is in the process of implementing a general permit program for these sources. Unless storm sewer runoff is a serious problem, there appears no need to issue any permits in the YTAPO area with its low population density.

It is anticipated that a generalized irrigation return flow permit will eventually be issued on a drainage basin basis. Only those return flows that are exceptionally low in quality may be required to obtain individual discharge permits. Implementing the 208's Best Management Practices for return flows should help control further reduction of water quality.

It is anticipated that most future energy related industries will be considered to be zero discharge industries. As a result, point source discharge permits will not be required. Many people question industry's ability to achieve an absolute lack of discharge, and it is anticipated that many energy related developments may increase the nonpoint source water quality problems in the area.

The discharge permits currently in force are listed in Table 4.

TABLE 4. Discharge permits in force on July 1, 1977.

DISCHARGE PERMITS			
Community	Existing Facility	Discharges	Permit Number
Baker	3-cell lagoon	Continuous	22381
Belle Creek	2-cell lagoon	Intermit.	22501
Broadus	2-cell lagoon	Intermit.	22110
Busby	2-cell lagoon	Intermit.	Permit in Process
Colstrip	3-cell lagoon	Intermit.	22373
Ekalaka	Activated Sludge	Continuous	20371
Forsyth	2-cell lagoon	Continuous	21288
Hysham	2-cell lagoon	Continuous	21709
Lame Deer	3-cell lagoon	Continuous	23141
Miles City	3-cell lagoon	Continuous	23612
Plevna	2-cell lagoon	Intermit.	21776
Shell Oil	Separation Pit	Intermit	329
Shell Oil	Separation Pit	Intermit.	311
Peabody	Settling Pond	Intermit.	884
Union Texas	Settling Pond	Intermit.	23752

NONPOINT SOURCES

Nonpoint sources of water quality problems -- salinity, sediment, etc., are very difficult to measure or control. Agricultural and construction activities accelerate natural erosion problems. The amount of erosion attributable to these activities is very difficult to isolate. Irrigation return flows aggravate natural salinity problems, but again the degree of man-caused contribution is very difficult to isolate.

It is easiest to describe nonpoint source problems on a drainage basin-by-drainage basin basis instead of attempting to describe them on a source-by-source basis.

The TONGUE RIVER currently does not have severe nonpoint source problems. However, due to its relatively high water quality, the potential for future impact is high. The major anticipated problems are increased sediment loads due to construction or mining related activities near the river channel, and increased salinity levels due to the modification of groundwater recharge areas by mining and an increase in irrigation return flows.

The POWDER RIVER currently has high salinity and sediment loads caused by man-aggravated natural sources. The actual contribution due directly to man is reasonably small and difficult to isolate. The current sediment load of the Powder River is quite high. Thus, it may not be possible to measure any increased sediment load due to man's future activities. In fact, the construction of Moorhead reservoir or similar structure might reduce sediment transport. Part of this reduction in sediment transport would be due to trapping the upstream contribution of sediment. Part of it would be due to controlled flow levels which would reduce the potential for eroding and transporting sediment. The potential for elevated salinity levels in the Powder River is quite severe. Existing salinity levels make the water marginal for irrigation by normal definition even though it is being used relatively successfully by property owners adjacent to the river. Energy related development and/or the expansion of irrigation could cause salinity levels to rise to the point where crop yields would be adversely affected. The selective use of the better water in the tributary area, (Wyoming) and evaporative losses from reservoirs (such as the proposed Moorhead reservoir) would elevate salinity levels.

Similar problems could occur on smaller streams. Otter Creek near Ashland and Pumpkin Creek between Broadus and Miles City have a high potential for disruption by energy related activities.

A factor which may assist in controlling future water quality is that during normal critical low flow periods, most smaller tributaries are dry and, therefore, do not contribute high dissolved solids or sediment loads to the main rivers. Conversely, however, there is no contribution of higher grade dilution water.

PROBLEMS AND OPPORTUNITIES

An "Executive Summary" of the proposed water quality management plan was prepared for a series of public meetings held in the project area on July 18 - 21, 1977. This summary contained a number of problems and opportunities along with suggestions for corrective or preventive actions. PROBLEMS were considered to be existing water quality factors, whereas OPPORTUNITIES were situations which may affect future water quality but for which preventative measures could be developed.

Those present at each of the public meetings were asked to rank the problems and opportunities as low, medium, or high priority items. Table 5 shows the results of the meetings. The questions have been re-arranged according to percentage rank in the high priority category. Table 6 presents the same information in a different fashion. The low percentage has been subtracted from the high percentage to give "net percentage points" for each item. While the technique of evaluation may be open to question as it assumes that low votes are negative, moderates neutral and highs positive, the results are interesting.

Attendees were also asked to jot down their comments. Table 7 lists the written comments received during the public meetings. The dominant verbal comment received at each of the four meetings, in essence, was "protect the groundwater."

The results of the public meetings appear to be a clear mandate to emphasize the protection of the groundwater. The three top-ranked items in Table 6 are strictly groundwater items and the fourth and sixth-ranked items are groundwater related. Excessive erosion from large acreages of small grains was the only non-groundwater items that was ranked high.

On the other extreme, the impact of animal wastes on streams and the sediment load of the Powder River were considered to be of minor importance. Factors contributing to the low ranking of these items may include:

1. We had no quantative data to show a negative impact of animal waste on the streams
2. A fear that additional regulations might be imposed upon farmers and ranchers.
3. Our inability to place a dollar value on the impact of the sediment being contributed to the Yellowstone River.
4. Few people attending the meetings had any direct knowledge of the impact of the sediment now carried by the Powder River.
5. The YTAPO area has few large year-round animal confinement facilities.

Possible alternatives for the control of the problems and opportunities that had a net positive point rating are given on pages 14 to 20. The sixth and eighth categories from Table 6 have been combined into one category.

Table 5. Summary Of The Questionnaire Used At The Public Meetings

Priority Low	Priority Med	Priority Hi	
06%	25%	63%	Prevention of permanent contamination of critical aquifers by solution mining.
10%	25%	57%	Prevention of contamination of certain geologic formations with man induced chemicals utilized in the tertiary recovery of petroleum.
20%	24%	52%	Excessive erosion from large acreages of small grain crops planted without implementation of accepted soil and water conservation practices.
12%	27%	51%	Mixing of various aquifers and loss of head on confined aquifers.
17%	29%	42%	Reduction of crop yield due to the concentration of salts in the soil or shallow groundwater.
05%	31%	40%	Prevention of an increase in the salinity of the Tongue River due to the expansion of mining and irrigation.
21%	26%	29%	Prevention of a decrease in crop yields due to the improper use of saline or sodium rich water for irrigation.
17%	33%	27%	Prevention of an increase in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.
39%	30%	25%	Discharge of untreated or partly treated household wastewater to streams or to the ground surface.
46%	27%	20%	Minor surface disturbances associated with drilling gas and oil wells and most exploratory drilling.
29%	46%	19%	Excessive erosion taking place along right-of-ways.
35%	35%	15%	Increased salinity levels in the downstream part of the Powder River and resulting contribution of saline water to the Yellowstone River.
36%	13%	11%	Occasional anaerobic conditions and accumulation of wastes in a slough in the northern part of Miles City.
51%	26%	07%	Increased sediment levels in the Yellowstone River below the mouth of the Powder River.
74%	19%	04%	The contamination of streams by animal wastes.

Table 6. Summary of the results of the public meetings, with the number of low rankings subtracted from the number of high rankings to give a "net favorable" response.

Net Points	
57	Prevention of permanent contamination of critical aquifers by solution mining.
47	Prevention of permanent contamination of certain geologic formations with massive quantities of man induced chemicals utilized in the tertiary recovery of petroleum.
39	Mixing of various aquifers and loss of head on confined aquifers.
35	Prevention of a measurable increase in the salinity of the Tongue River due to the expansion of mining and irrigation.
32	Excessive erosion from large acreages of small grain crops planted without implementation of accepted soil and water conservation practices.
25	Reduction of crop yield due to the concentration of salts in the soil or shallow groundwater.
10	Prevention of measurable increases in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.
8	Prevention of a measurable decrease in crop yields due to the improper use of saline or sodium rich water for irrigation.
-10	Excessive erosion taking place along roads and other right-of-ways.
-14	Discharge of untreated or partly treated household wastewater to streams or to the ground surface.
-20	Increased salinity levels in the downstream part of the Powder River and resulting contribution of saline water to the Yellowstone River.
-25	Occasional anaerobic conditions and accumulation of wastes in a slough in the northern part of Miles City.
-26	Minor surface disturbances associated with drilling gas and oil wells and most exploratory drilling.
-44	Increased sediment levels in the Yellowsotne River below the mouth of the Powder River.
-70	The contamination of streams by animal wastes.

Table 7. Summary of written comments received at the public meetings.

Develop lists of crops that can tolerate saline or high sodium soils.

The impact of salinity on crop yields is beyond the scope of a water quality study.

The past record shows that industry only does a good job if there are adequate controls to prevent problems.

There is a delay in the implementation of conservation practices on BLM land as the EIS isn't complete.

Install more dikes to hold the runoff to better utilize the existing moisture.

Loss of water to slurry pipelines, cooling towers, etc. will decrease the amount of water to dilute pollutants.

The discharge of partly treated municipal wastewater is correctable.

Make right-of-ways smooth and plant hay - will improve road and hay can be used.

Raise the priority of the sediment and salinity problems if mining occurs.

Give range management practices a higher prioity.

Existing water rights should be allowed adequate water quality.

What are the impacts of grasshoppers vs the chemicals to control the grasshoppers.

Better voluntary land management by the owners would help sediment problems.

Develop off-channel storage reservoirs on the Yellowstone River would assist farmers in land management.

Rosebud County should develop guidelines for septic tank system installation.

Determine the potential for saline seep prior to the installation of new irrigation systems.

Loss of local control if the project is not handled properly.

Replace aquifers that are destroyed during coal mining.

(1) OPPORTUNITY: Prevention of permanent contamination of critical aquifers by solution mining.

Background: Extensive exploration for uranium in parts of Carter County indicates the possibility of solution mining in the Fox Hills or other geologic formations. The Fox Hills formation is an important aquifer.

ACTION	PROBABLE EFFECT
A. Require the plugging of all exploratory holes.	Reduce the probability of cross contamination between aquifers. Prevent the vertical movement of mining fluid.
B. Require monitoring of the mining process and notification of "lost" mining solution.	Reduce the probability of the contamination of the aquifer outside of the active mining area.
C. Require the reclamation of the mined zone via flushing and/or neutralization.	Remove of residual contaminants to allow the future use of the aquifer. Flushing may create a residual waste problem. The contaminated water must be treated.
D. Designate an aquifer for domestic use only as outlined in the federal Safe Drinking Water Act.	Must show imminent and substantial danger to health from contaminants. Would appear difficult to substantiate at this time.

Comments: Due to the timing of the project, the YTAPO was forced to initiate these actions prior to the public meetings. A bill was introduced into the legislature to extend the moratorium on solution mining until the Water Quality Bureau could establish regulations for solution mining. Our groundwater report by Willard Owens Associates contains information for the Water Quality Bureau to use in the development of the regulations outlined above.

It is recommended that a permit program be established to control solution mining. The application for the permit should include data on the area to be mined, monitoring procedures, emergency procedures, and alternative reclamation techniques. As solution mining techniques are still somewhat experimental, a pilot test should preceed any full scale mining. A bond adequate to cover the cost of reclamation and the plugging of all wells should be required.

(2) OPPORTUNITY: Prevention of contamination of groundwater as the result of the tertiary recovery of petroleum.

Background: A large scale pilot project with the use of chemicals for the tertiary recovery of petroleum is in progress at the Belle Creek field. It is believed that the chemicals to be used, probably petroleum sulfonates, ethoxyalated alcohols and polyacryliamides, are relatively non-toxic and will be confined to the geologic formation from which petroleum is being extracted. However, as of August 5, 1977, the YTAPO has not been able to obtain satisfactory information on the possible long-term effects of these chemicals. The federal agency (ERDA) funding the experiment did not prepare an environmental assessment for the project and was not able to provide information concerning the probable impact of the project.

	ACTION	PROBABLE EFFECT
A.	Require data on the long-term effects on the chemicals and on the potential for "leakage" before any full scale project is started.	Would allow the continuation of the experimental project, but require evaluation of probable impacts prior to any major use of the process.
B.	Require an agency other than ERDA or the Oil and Gas Commission to review the results of the pilot project.	Remove the review process from those agencies which appear to have a vested interest in the success of the project.

Comments: The YTAPO believes the Energy Research & Development Administration, now part of the Office of Energy, was remiss in failing to investigate the possible side effects of the process prior to funding a large scale experiment. As the data available in early 1976 did not indicate a high probability of major problems, the YTAPO did not attempt to force the preparation of an environmental assessment on the project at the expense of stalling a major experiment on energy extraction.

The YTAPO recommends that the Oil & Gas Commission should not approve any additional work involving the micellar-polymer tertiary recovery process until the long-term effects of the process and the potential for "leakage" have been properly determined.

Supportive information is contained in our groundwater report by Willard Owens Associates.

(3) PROBLEM: The mixing of various aquifers and the loss of head on confined aquifers.

Background: Conversations with well drillers and residents of the project area indicate that the preservation of good quality groundwater is a high priority item. Past exploratory and well drilling practices have resulted in hundreds of improperly cased wells and unplugged drill holes.

	ACTION	PROBABLY EFFECT
A.	Regulate all drilling and require the plugging of all abandoned holes.	Would control the expansion of the problem, but would not affect the existing unplugged holes.

Comments: This recommendation is being implemented. Due to the timing of the project, action was started on this prior to the public meetings. Several discussions have been held with the Department of State Lands and other agencies. The Department of State Lands and the Oil & Gas Commission will be asked to require that all exploratory holes drilled to a depth of over 30 feet or entering groundwater be plugged with a special bentonite mixture. Plugging shall be from the bottom up, with the possible exception of seismic holes, and drill cuttings shall NOT be returned to the holes. Holes penetrating confined aquifers shall be plugged with cement which has been properly mixed so as to inhibit deterioration when in contact with the specific subsurface conditions.

Supportive information is contained in our groundwater report by Willard Owens Associates.

Additional recommendations to consider:

A. Field inspection of all drill holes. The Department of State Lands will be asked to increase the frequency of field inspections. Perhaps the maintenance of the integrity of our groundwater system is critical enough to require the inspection of all drill holes and water and petroleum wells.
B. Maintain a central data bank on all drilling. This would be expensive but may prove useful in the future.
C. Retroactive plugging of abandoned wells and drill holes. This would be quite expensive. It would also be difficult to locate the wells and drill holes.
D. Cap or valve all flowing wells. Section 89-2926 of the existing Montana water law prohibits the waste and contamination of groundwater and specifically requires that all flowing wells be valved or capped. This regulation is not enforced.

(4) OPPORTUNITY: Prevention of a measurable increase in the salinity of the Tongue River due to the expansion of mining, energy conversion, and irrigation.

Background: The expansion of irrigation will increase return flows and the extractive use of water by industry will reduce the dilution flows. Mining "uphill" from the river will cause an increase in the salinity of the groundwater that seeps into the river. However, it not currently possible to determine the exact magnitude of this potential problem. The new federal stripmining act restricts mining in alluvial valleys. The final regulations have not been released by the Department of Interior, but it looks as if little stripmining will occur in alluvial valleys.

	ACTION	PROBABLE EFFECT
A.	Restrict mining between the groundwater recharge area and the river.	As more geologic data and interpretive tools become available, certain sensitive areas should be delineated.
B.	Require selective placement of spoils in mined areas so that they will intercept the significant flows to groundwater.	The effectiveness of the procedure has not been documented.
C.	Develop waste load allocations for dissolved solids.	Difficult procedure for nonpoint sources, especially when the impact of mining will not be documented until several years after the mine is started.
D.	Attach a water quality criteria to water rights.	Guarantee that those holding existing water rights will be provided with water of usable quality.
E.	Initiate an irrigation and water quality education program.	Increase awareness over a period of years.

Comments: This is one of the best opportunities the YTAPO has to prevent the significant deterioration of a river. However, while most professionals agree on the probable effects of mining, irrigation, and flow depletion, the tools currently available are not good enough to provide firm estimates of the impacts of certain actions on water quality.

Actions A and B should be considered by the Department of State Lands whenever it reviews a mining plan. The Bureau of Land Management should also consider these impacts when it reviews recommendations for leasing.

Action C will have to be addressed by the Water Quality Bureau in the near future and Action D should be pursued in the next session of the legislature.

(5) PROBLEM: Excessive erosion from large acreages of grain crops planted without implementation of accepted soil and water conservation practices.

Background: Grazing land has been converted to grain land quite rapidly during the last few years. Adverse weather conditions could harm several hundred square miles of land. Wind erosion may be more harmful than water erosion.

ACTION	PROBABLE EFFECT
A. Establish an "enhanced" voluntary erosion control program through the Conservation Districts.	The control would be primarily "after the fact" in that action could not be taken against uncooperative property owners unless a problem was already in existence.

Comments: The Conservation Districts have asked to be part of the program for implementing erosion and salinity control measure. They will adopt standardized procedures for reviewing problems and attempt to obtain voluntary action on the part of the property owner. Any enforcement will be referred to existing state agencies.

Additional recommendations to consider:

A. Establish bonding and reclamation procedures.
B. Require the development of a conservation plan prior to breaking.
C. Link price supports to the utilization of soil and water conservation practices.
D. Subsidize the revegetation of marginal cropland.
E. Statewide erosion and sedimentation control program.

Comments: This is one of the more politically and socially sensitive issues the YTAPO must address. There appears to be support for the control of large property owners, but general land use controls would not be well received. If pushed, it may mean the loss of credibility and support for other portions of the YTAPO project.

(6) OPPORTUNITY: Control existing irrigation salinity problems and prevent future decreases in crop yields due to the improper use of saline or sodium-rich water.

Background: Except for the Yellowstone and Tongue Rivers, most sources of irrigation water fall within the U.S. Department of Agriculture's high or very high salinity categories. Most well water falls in the very high sodium category. Salinity has not been recognized as a problem in the past. Reduced yields due to "bad spots" in fields, etc., have been considered to be natural problems that one tolerates and works around.

	ACTION	PROBABLE EFFECT
A.	Provide salinity measuring equipment and interpretive materials to each county.	Increased awareness of salinity problems and the alternatives. Allow farmers to help themselves in determining if a problem exists.
B.	Place additional stress on salinity at farm meetings and in Vo-Ag classes.	As above.
C.	Develop a monitoring program to determine salinity levels.	Assist those using return flows and the poorer quality surface water.
D.	Establish interstate salinity maximums.	Deter Wyoming from using only good quality water and sending Montana poor quality water.
E.	Provide an awareness of possible problems when using sprinkler systems with low quality water.	Decrease the number of people stuck with systems that do not work and maintain the productivity of the soil.
F.	Require an evaluation of the water supply and the soil prior to the construction of any government funded irrigation system.	Proper interpretation of the data would indicate probable management constraints and prevent the construction of systems that would fail within a few years.

Comments: All actions should be implemented.

The YTAPO is in the process of determining what types of salinity measuring equipment are suitable and plans to obtain basic equipment for use within the project area.

The Extension Service and SCS personnel appear to be the logical choice to assist in the implementation of most of the above recommendations.

Action F is the only recommendation the YTAPO received any formal protests on after the public meeting.

(7) OPPORTUNITY: Prevention of measurable increases in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.

Background: Mining, construction, and agricultural activities taking place immediately adjacent to the river channel will have a noticeable impact on the river due to the short distance which the sediment would be transported.

ACTION	PROBABLE EFFECT
A. Restrict mining adjacent to the river channel.	Would control one source of sediment.
B. Restrict right-of-way construction adjacent to the river channel.	Application of strict erosion control practices to any construction that does occur.
C. Implement full conservation practices on land adjacent to the river.	Should supplement Actions A and B.

Comments: The Conservation Districts have asked to be involved with erosion control from construction sources as well as from agricultural sources. They will adopt standardized procedures for reviewing problems and will attempt to obtain voluntary action on the part of the responsible party.

An attorney working for the YTAPO has written a model right-of-way lease which incorporates safeguards for the property owner and the environment.

Roads and railroads have been traditionally constructed along rivers as the topography allows for less expensive construction. Also, it appears that the railroads have traditionally been somewhat outside the normal processes utilized for controlling erosion on construction projects, etc.

The YTAPO recommends that if manpower and finances are limited, the Tongue River area should receive priority in erosion control enforcement due to the relatively high quality of the existing river and due to the high probability of construction activities taking place near the river channel.

Return of topsoil, sediment control structures, etc., should be part of any construction projects in this area.

IMPLEMENTATION

The YTAPO staff recommends the procedure outlined in Figure 1 as the basis for the implementation of the 208 program. Additional detail is contained in Chapters V, VII, and VIII.

This is an interim implementation procedure to be utilized until the impact of coal development is great enough to justify the establishment of a "Technical Support Group" which is outlined in Figure 2.

The YTAPO should be continued as the "Coordinating Board" for this procedure. To simplify the operation of the "Coordinating Board", it might be desirable to modify the structure of the existing YTAPO so that the voting members are composed of a County Commissioner from each of the six counties. It would then be possible for the "Coordinating Board" to hold its meeting the same day the District 3 County Commissioners' meeting is held.

A "Soil and Water Conservation Planner" has been hired. He will complete any remaining functions of the original 208 program and will assist the Conservation Districts in assuming their responsibilities under the continuation of the 208 process.

The Conservation Districts are a key element to the implementation of the program. The diagram in Figure 1 indicates that they will be the lead agency to work with erosion and salinity related problems. Their role is expanded in Figure 3.

This "voluntary" role of the Conservation Districts may change in the future. The Montana Association of Conservation Districts is exploring the possibility of encouraging the adoption of a sediment control ordinance on a county-by-county basis. Others are exploring the possibility of the legislature passing a state-wide sediment control law.

It appears desirable to establish the role of the Conservation Districts even though there is some question as to what will happen in the future. The process outlined in Figure 3 can be established by a vote of the Board of Supervisors of each District. It is a program of cooperation with the Water Quality Bureau as opposed to the adoption of an ordinance which gives the Conservation District direct regulatory power over any actions that might cause accelerated rates of erosion. The Districts will assume this role with the understanding that the State of Montana will provide the Districts with protection from legal liability and provide legal assistance if suits or enforcement actions are necessitated by implementing the 208 plan.

Figure 1. Schematic of interim management process.

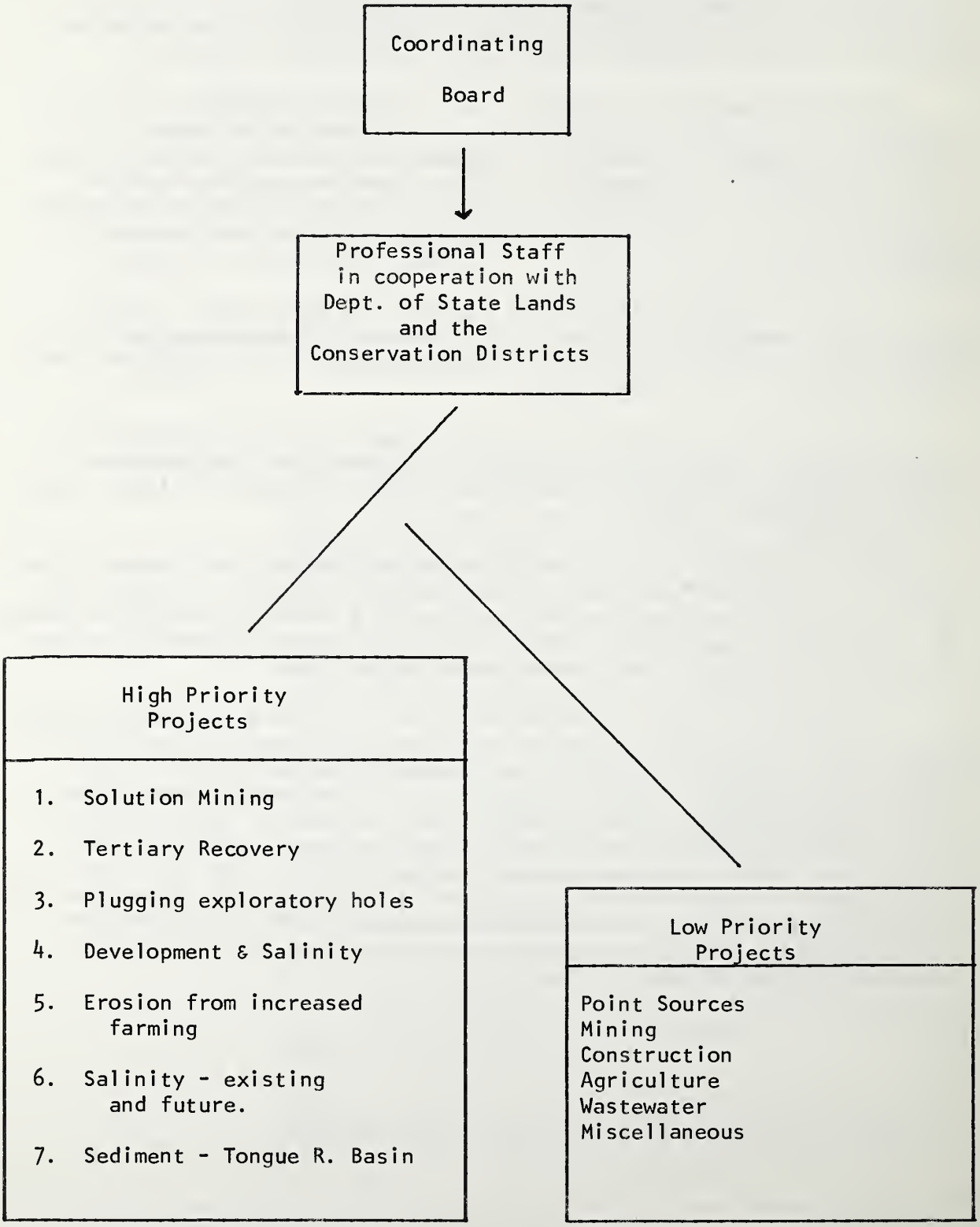


Figure 2. The "Technical Support Group".

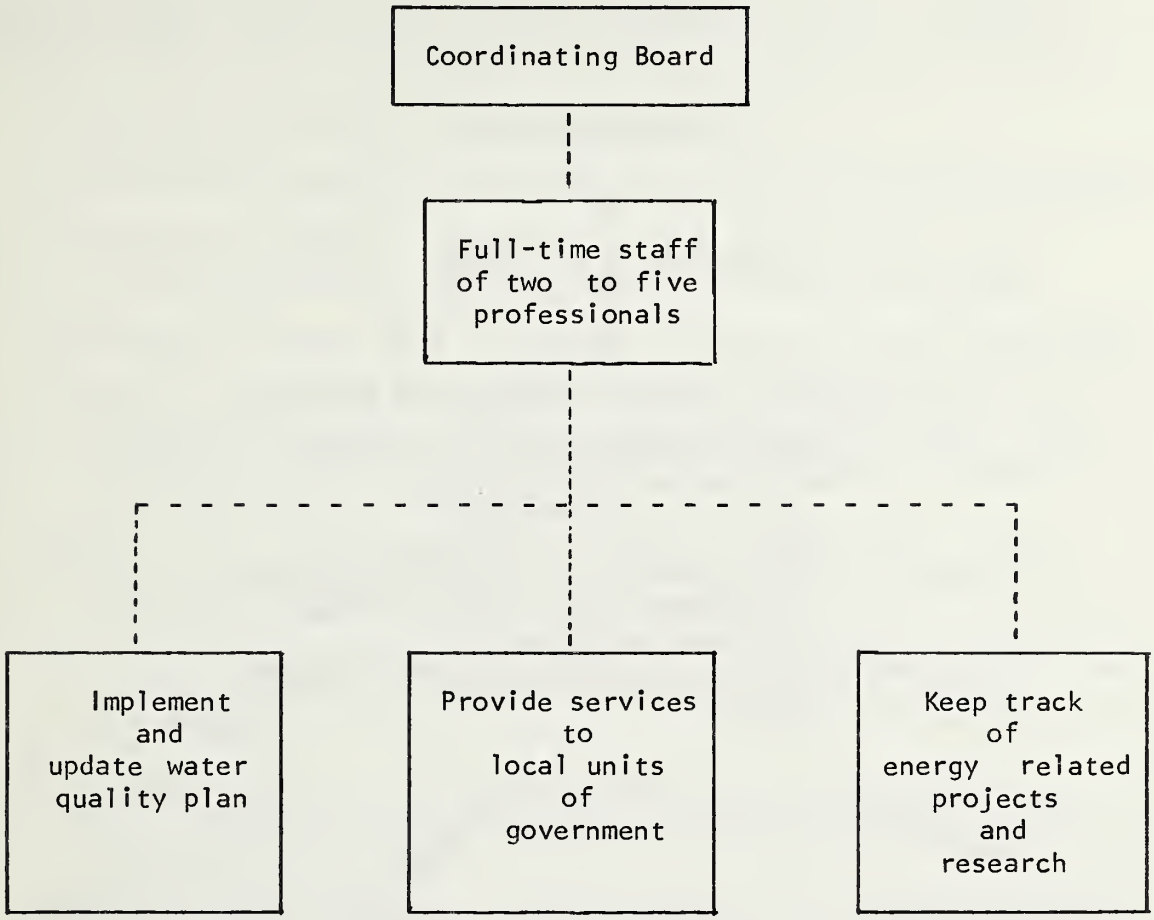


Figure 3. FLOW CHART FOR ACTION BY THE CONSERVATION DISTRICTS

A problem exists.

↓

Complaint is filed.

↓

Conservation Districts look at the problem.

1. Determine magnitude of the problem.
2. Determine cost-effectiveness of correcting the problem.
3. Suggest corrective procedures and time schedule, with the assistance of the SCS, Water Quality Bureau, and technical staff.
4. Assist with the availability of cost-sharing.

Problem is solved.

↓

Task complete.

Problem is not corrected.

Owner refuses to cooperate.

↓

Refer to Water Quality Bureau

Not economically feasible to correct.

↓

Design measures to minimize impact of the problem.

IMPLEMENTING AGENCIES

The following agencies will be asked to officially participate in the implementation of the Water Quality Management Plan. If they agree to participate, the YTAPO will request that the Governor of Montana designate them as the lead management agencies of the topics specified.

YELLOWSTONE-TONGUE APO -- coordinating body

CONSERVATION DISTRICTS -- sediment and salinity from nonpoint sources

WATER QUALITY BUREAU -- municipal and industrial point sources, solution mining for uranium, subsurface disposal of wastes

DEPARTMENT OF STATE LANDS -- surface mining and minerals exploration

ROSEBUD, CUSTER, AND POWDER RIVER COUNTIES, AND THE INCORPORATED COMMUNITIES OF BAKER, BROADUS, EKALAKA, FORSYTH, HYSHAM, MILES CITY, AND PLEVNA -- the wastewater collection and treatment systems in their judisdictions

NORTHERN CHEYENNE INDIAN TRIBE -- those activities taking place upon the Northern Cheyenne Indian Reservation

U.S. ENVIRONMENTAL PROTECTION AGENCY -- point sources arising from the Northern Cheyenne Indian Reservation and from federal installations

U.S. FOREST SERVICE -- implement BMP's regarding watershed management, timber harvesting, grazing and other activities on the Custer National Forest

BUREAU OF LAND MANAGEMENT -- implement BMP's for grazing and other activities on BLM land

Several agencies will not be designated as management agencies, but will be asked to assist in the implementation of the water quality management plan. They include:

County Planners
County Sanitarians

Dept. Health & Environmental Sci.
- Air Quality Bureau
- Solid Waste Bureau
- Subdivision Bureau

Dept. of Community Affairs
Dept. of Natural Resources & Conservation
Dept. of Fish and Game
Interstate Commerce Commission
Bureau of Mines and Geology
Oil & Gas Commission
State Highway Department
Environmental Quality Council
U.S. Geological Survey
Soil Conservation Service
Cooperative Extension Service
Agricultural Stabilization & Conservation Service
Corps of Engineers
Bureau of Reclamation
Office of Energy

PROJECT AREA

GENERAL DESCRIPTION

The Yellowstone-Tongue Areawide Planning Organization was formed as a result of the provisions set forth in Section 208 of the Federal Water Pollution Control Act of 1972. This section enables local units of government to request funds to participate in the development of a water quality management plan for their area.

As with most organizations, a governing body was needed. Therefore, the six counties in the YTAPO established a Board of Directors. (Table 8). A commissioner from each county along with mayors of incorporated towns, who chose to participate, compose the Board. A staff was then created to coordinate the project. (Table 9). By mid-September 1975, with the hiring of a project director, secretary, water quality specialist, planner/ public relations director, and part-time bookkeeper, the project was in the works.

To help coordinate with various federal, state, and local agencies already involved with water policy, the Board agreed to establish a Technical Advisory Committee. (Table 10). Recommendations from the Technical Advisory Committee and the Board of Directors provided assistance to the YTAPO staff in defining and prioritizing water quality problems within the project area.

The Water Pollution Act set a two-year limit on water quality projects. This required the YTAPO to contract several consultants to assess, research, document, and evaluate water problems and prepare reports including appropriate recommendations for best management practices. (Table 11). Final reports were submitted from the consultants and are included as support material for the final plan.

LAND USE

Historically, this area of Southeast Montana has always been used as rangeland with intermingling areas of cropland. Today, agriculture usage including rangeland, dryland, and irrigated cropland accounts for about 90% of the YTAPO area. (Table 12).

From Table 12 we can break down land ownership in the YTAPO area as follows: private - 72%, federal - 19%, state - 7%, and Indian - 2%. The past several years have seen a change in land use from rangeland to dryland cropland, especially in northern Custer and Rosebud Counties. With the depressed wheat prices, this land may lay fallow and create erosion and sediment problems.

The amount of irrigated cropland will continue to increase as operators put their land under more intensive management. The strip mining of coal has become a controversial land use issue within the

Table 8. Yellowstone-Tongue APO Board of Directors

Floyd Irion, Chairman, Powder River County Commissioner
Joseph Padden, Carter County Commissioner
John Beardsley, Custer County Commissioner
A.W. Kamhoot, Rosebud County Commissioner
Norris Cole, Treasure County Commissioner
Delane Beach, Fallon County Commissioner
Bill Woessner, Northern Cheyenne Research Project
Ron Talcott, Mayor of Broadus
Gene Kurtz, Mayor of Forsyth

Table 9 Staff Members of Yellowstone-Tongue APO

Clark Judy	Project Director
Ambrey Gartner	Water Quality Specialist
Dorel A. Hunt	Planner/Public Relations Director
Doris Turnbough	Secretary
Karen Amende	Bookkeeper
Paul Gipe	Environmental Scientist
Mrs. John Mobley	Technical Writer
Lyn Buss	Temporary Field Assistant
Julie Quaring	Temporary Office and Field Assistant
Valli Jo Richards	Temporary Office Assistant
Tom Demaree	Soil and Water Conservation Planner
Debbie Riffle	Secretary

Table 10. Yellowstone-Tongue APO Technical Advisory Committee Members

David Albersworth, Northern Plains Resource Council
Bob Bennett, Bureau of Land Management
Mike Bishop, Department of State Lands
Allen Bond, Mid-Yellowstone APO
Roger Dean, Environmental Protection Agency
Tom Eggensperger, Fallon County Sanitarian
Al Elser, Montana Department of Fish & Game
Carlene Farmer, State 208 Coordinator
Gary Fritz, Department of Natural Resources & Conservation
Barbara Garrett, Department of Community Affairs, Coal Board
Rick Gold, Bureau of Reclamation
Richard Hutchinson, U.S. Geological Survey
Steve Hamann, Custer/Powder River County Sanitarian
Larry Ivanovitch, State Department of Highways
E. Lee Jones, Area Conservationist - SCS
Barbara Kennedy, Custer/Powder River County Planner
T.L. Lippert, Tri-County Sanitarian
Marvin Miller, Bureau of Mines and Geology
Del Mitchell, U.S. Forest Service
Martin Oleson, Missouri River Basin Commission
Steve Onisco, Bonneville Power Administration
Tom Osborne, Northern Cheyenne Research Project
Steve Pilcher, Water Quality Bureau
Bruce Rehwinkle, Montana Department of Fish and Game
Eldon Rice, Rosebud County Planner
Larry Scanlan, Southeastern Montana Assoc. Cons. District
Tom Schmidt, Air Quality Bureau
Dick Shelton, Powder River APO
F.H. Siddoway, Northern Plains Soil & Water Research Center
Thomas Smith, Montana Power
Gib Sperling, Gary Operating Company
Stan Steadman, Department of Community Affairs
Mark Stevens, Rosebud County Sanitarian
Bob Sutton, Northern Powder River Basin EIS
Jeff White, Bureau of Reclamation
Mike Whittington, Bureau of Land Management
Ray R. Woodward, U.S. Range/Livestock Experiment Station
U.S. Army Corps of Engineers, (no designated contact)
Lt. Governor's Office, (no designated contact)

Table 11. CONTRACTS WITH THE YTAPO

Project	Consultant
Northern Cheyenne "208" Plan	Northern Cheyenne Tribal Council
Nonpoint Source	Montana Testing Lab
Nonpoint Source Data Collection	Conservation District
Water Quality Assistance	Montana Water Quality Bureau
Ground Water Data Compilation	Montana Bureau of Mines and Geology
Ground Water Quality Interpretation	Willard Owens Associates
Land Use Mapping	
Forsyth Sewage System Plan	Morrison-Maierle, Inc.
Broadus Sewage System Plan	Morrison-Maierle, Inc.
Hysham Sewage System Plan	Hurlbut, Kersich & McCullough
Rosebud Sewage System Plan	Plains Engineering
Soils Mapping	Conservation District (mapping by SCS)
Forsyth Storm Runoff	Morrison-Maierle, Inc.
Hysham Ground Water	Hurlbut, Kersich & McCullough
Miles City Storm Runoff	Miles City Lab
Custer County Water and Sewer District	Morrison-Maierle and YTAPO
Baker Vicinity Sewage System Plan	Christian, Spring, Sielbach & Associates
Salinity/Irrigation	Franklin & deMooy

Table 11, continued. CONTRACTS WITH THE YTAPO

Project	Consultant
Aerial Photography	Bill Woodcock Miles City, Montana
Water Quality Movie	D. Drum and C. Jorgensen
Legal Services	R. Klinger
Urban Runoff and Flood Plains Map	Olson-Elliott and Associates

Table 12 LAND USE ACREAGE OF SIX COUNTY STUDY AREA

March 1977

	Cropland			Rangeland				Woodland					
	1/ Irrigated	Non-Irrigated	2/ Total	3/ BLM	Private	Total	4/ Pasture	3/ Forest Service	4/ Private	Total	4/ Urban Land and Small Water Areas	4/ Other Land	4/ Total Area
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Carter	2,185	143,376	145,561	512,333	1,299,217	1,811,450	32,500	89,400	25,756	115,156	12,593	3,060	2,120,320
Custer	42,244	90,681	132,925	393,871*	1,769,513	2,163,384	25,300		56,500	56,500	23,391	8,100	2,409,600
Fallon	2,433	252,128	254,561	121,906	629,914	753,488	20,000		760	760	11,847	4,464	1,045,120
Powder River	33,339	141,603	174,942	262,401**	1,119,695	1,456,384	30,000	341,946	85,528	427,474	7,800	5,800	2,102,400
Rosebud	32,271	145,887	178,158	233,690	2,444,169	2,677,859	25,748	95,827	220,690	316,517	8,312	13,886	3,220,480
Treasure	21,231	20,945	42,176	11,892***	520,750	532,642	6,060		38,603	38,603	5,300	4,979	629,760
Area	133,703	794,620	928,323	1,536,093	7,857,158	9,395,207	139,608	527,173	437,837	955,010	69,243	40,289	11,527,680

* Includes 168 acres BSF & W and 5,228 ARS

** Includes 4,565 acres Bureau of Reclamation

*** Includes 8 acres Bureau of Reclamation

1/ From Yellowstone River Basin Water Resources Situation Report 1975.

2/ From Bureau of the Census, 1970, with additional acreage for recent plowing of rangeland as estimated by District Conservationists.

3/ From BLM and Forest Service.

4/ From Montana Soil and Water Conservation Needs Inventory.
"other land" includes farmsteads, farm roads, feed lots, ditch banks, fence rows, rural nonfarm residences, investment tracts, strip mines and borrow pits.

project area. Though the acreage disturbed by actual mining is comparatively small, its impacts significantly affect the socioeconomic balance of the area. Proposed expansions of existing mines and the opening of new mines along with the construction of new power plants in the area will definitely alter the land use patterns. However, the changes are currently only predictions and actual development plans remain speculative for the most part.

VEGETATION

In very general terms the vegetation naturally found in the project area falls into three vegetation types: grassland, pine forest, and badlands, (see map on following page).

Vegetation can deviate from climax from influencing factors such as grazing, insects, fire, and other disturbances. In the absence of the original kind or amount of grassland cover, the permanent features of the site, the soil and the climate must be used as the identifying criteria.

Grassland portions are usually flat to rolling with occasional streams meandering down slope. Used primarily as range, these native grasses are generally encouraged because of the grazing value to the herds of cattle and sheep.

The pine forest areas are usually restricted to slightly higher elevations often associated with outcrops of sandstone formations. These areas are favored due to the increased precipitation available at those higher elevations.

The final category, known as badlands, offers only a sparce, hardy vegetative cover intermingled with exposed, weathered slopes of shales, mudstone and siltstone. Unstable nutrient, poor soils, and semi-arid environment team up to make these areas physically displeasing to most plant life.

Considerable research has been conducted to identify and map native climax vegetation by various agencies. The best composite map was prepared by the Soil Conservation Service -- a map of climax vegetation with thematic detail compiled by Montana State staff.

The following map is reproduced from this larger map and is followed by the comprehensive legend for each of the numbered areas shown. Included are general soils, average available precipitation, dominant climax vegetation.

GEOLOGY

The sedimentary rocks exposed throughout the YTAPO planning area of Southeastern Montana consist of strata deposited relatively late in the geologic time sequence, which were periodically interrupted only for

CLIMAX VEGETATION IN SOUTHEASTERN MONTANA

EASTERN SEDIMENTARY PLAINS

14 Silty Range Site, 10-14" P. Z.

(Includes thin breaks too small or irregular to delineate.) Western and thickspike wheatgrass, little bluestem, needleandthread green needlegrass, bluebunch wheatgrass, big bluestem, prairie junegrass, threadleaf sedge, native legumes, silver sagebrush, skunkbush sumac, winterfat, blue grama, western snowberry

15 Silty Range Site, 15-19" P. Z.

Western and thickspike wheatgrass, green needlegrass, little bluestem, big bluestem, bluebunch wheatgrass, Idaho fescue, sideoats grama, n legumes, needleandthread, prairie junegrass, silver sagebrush

16 Silty-Clayey Range Site Complex, 10-14" P. Z.

(Includes thin breaks too small or irregular to delineate)

Silty: Same as Site No. 14

Clayey Same as Site No. 18

17 Silty-Clayey Range Site Complex, 15-19" P. Z.

Silty: Same as Site No. 15

Clayey: Same as Site No. 19

18 Clayey and Shallow Clay Range Site Association, 10-14" P. Z.

Western and thickspike wheatgrass, green needlegrass, little bluestem, bluebunch wheatgrass, prairie junegrass, native legumes, big sagebrush, Nuttall saltbush, winterfat

19 Clayey and Shallow Clay Range Site Association, 15-19" P. Z.

Green needlegrass, western and thickspike wheatgrass, bluebunch wheatgrass, basin wildrye, big bluestem, little bluestem, Idaho fescue, prairie junegrass, prairie sandreed, native legumes, big sagebrush, Nuttall saltbush, winterfat

20 Dense Clay-Clayey-Saline Upland Range Site Complex, 10-14" P. Z.

Dense Clay: Western and thickspike wheatgrass, green needlegrass, basin wildrye, big sagebrush, Nuttall saltbush, greasewood, prairie junegrass

Clayey: Same as Site No. 18

Saline Upland: Alkali sacaton, western and thickspike wheatgrass, greasewood, basin wildrye, Nuttall saltbush, inland saltgrass, bottlebrush squirreltail, Sandberg bluegrass

21 Sands and Sandy Range Site Association, 10-14" P. Z.

Sands: Prairie sandreed, needleandthread, sand bluestem, Indian ricegrass, little bluestem, sun sedge, native legumes, skunkbush sumac, yucca

Sandy: Needleandthread, prairie sandreed, threadleaf sedge, little bluestem, sideoats grama, big bluestem, native legumes, blue grama, skunkbush sumac, rose

22 Riverbreaks, 10-14" P. Z.

Ponderosa pine, Rocky Mountain juniper, western and thickspike wheatgrass, bluebunch wheatgrass, green needlegrass, prairie sandreed, little bluestem, greasewood, big sagebrush, needleandthread, Nuttall saltbush basin wildrye, native legumes, shadscale saltbush, creeping juniper

23 Badlands, 10-14" P. Z.

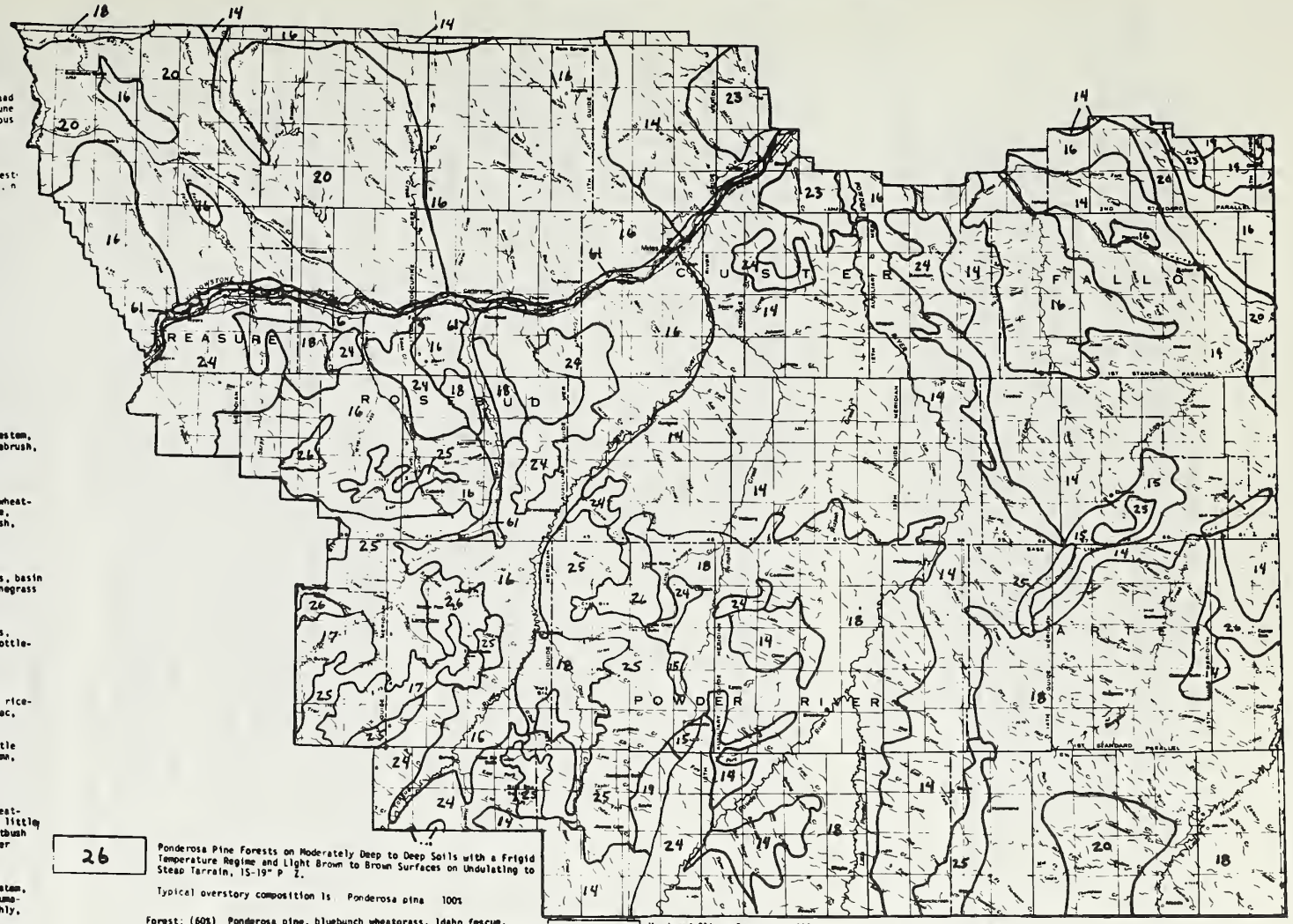
Western and thickspike wheatgrass, green needlegrass, little bluestem, bluebunch wheatgrass, prairie sandreed, alkali sacaton, prairie junegrass, Nuttall saltbush, big sagebrush, American vetch, plains muhly, sideoats grama, greasewood, juniper

24 Forest-Grassland Complex, 12-14" P. Z., on Very Shallow to Deep Soils with a Frigid Temperature Regime and Light Brown, Loamy Surfaces on Rolling to Hilly Terrain

Forest: (50%) Ponderosa pine, Rocky Mountain juniper, little bluestem, bluebunch wheatgrass, sideoats grama, skunkbush sumac, western wheatgrass, native legume

Grassland: (50%) Little bluestem, needleandthread, western wheatgrass, green needlegrass, bluebunch wheatgrass, prairie sandreed, big bluestem, native legumes, skunkbush sumac, yucca, prairie junegrass, blue grama

25 Forest-Grassland Complex, 15-19" P. Z., on Very Shallow to Deep Soils with a Frigid Temperature Regime and Light Brown, Loamy Surfaces on Undulating to Hilly Terrain



26 Ponderosa Pine Forests on Moderately Deep to Deep Soils with a Frigid Temperature Regime and Light Brown to Brown Surfaces on Undulating to Steep Terrain, 15-19" P. Z.

Typical overstory composition is Ponderosa pine 100%

Forest: (60%) Ponderosa pine, bluebunch wheatgrass, Idaho fescue, little bluestem, sideoats grama, snowberry, native legumes, arrowleaf balsamroot, green needlegrass, common chokecherry, saskatoon serviceberry

Grassland: (40%) Big bluestem, bluebunch wheatgrass, western wheatgrass, green needlegrass, needleandthread, prairie junegrass, basin wildrye, lupine, snowberry, saskatoon serviceberry common chokecherry

61 Hardwood Climax Forests on Alluvial Floodplains Along Major Rivers and Growing on Shallow to Deep, Well Drained to Poorly Drained Soils with Frigid Temperature Regimes

Typical overstory composition is:

East of Continental Divide:	Cottonwood	80%
	Other hardwoods	20%
West of Continental Divide:	Cottonwood	80%
	Conifers	20%

YELLOWSTONE-TONGUE A.P.O.

Funded by an E.P.A. section 208 grant

1976

periods of uplift and erosion. In general, the strata lay nearly horizontal or slightly dipping over the major portion of the area. Three structural upheavals known as uplifts have taken place since these exposed strata were deposited. The southern portions of Carter and Powder River Counties lay on the western edge of the Black Hills Uplift. Fallon County has been altered by an uplifting force creating the Cedar Creek Anticline. The third obvious geologic modification was the bubble-like upward thrust from inside the earth which created the Porcupine Dome in Northwestern Rosebud County.

The following is a description of the geology of the planning area on a county-by-county basis.

Carter County -

The geology of Carter County may be described as an upland plain trenched by numerous streams. The upland plain is rolling for the most part and, in general, creek valleys are shallow and the divides are broad and flat. Locally, the uplands are rugged due to the differential erosion of hard and soft strata. Soils are deep enough in much of the upland area for crop production.

Gravel deposits found in the county lie at different levels indicating several stages of an old erosion and sedimentation cycle. The highest deposits are perhaps a million years old; or in the Miocene time. Gravel somewhat lower in early Pliocene time and deposits near the river in early Pleistacene are the more recent stages of the erosion cycle.

The sedimentary rocks exposed in this region consist of strata laid down relatively late in geologic time. In central and southern Carter County older formations, such as the Bearpaw shale, appear at the surface. Near Ekalaka, high hills are locally capped by strata of the White River and possibly the Arikaree formations, the youngest consolidated sediments in Southeastern Montana.

The White River formation in Carter County is commonly called the "Chalk Buttes". These deposits are the last of the thick fresh-water sedimentary series which were deposited in Montana and Wyoming in early and middle Tertiary time.

The Fort Union formation consists of 1,500 feet or more of alternating beds of sandstone and shale with occasional beds of coal. It underlies the surface in parts of the northeastern upland region of the district. It has been separated into two divisions: an upper (Tongue River) member where massive sandstone is plentiful, and a lower (Lebo) shale member.

A. The Tongue River member lies exposed at the surface in an area around the northern edge of the Ekalaka Hills. Its most distinguishing characteristic being the bright red scoria beds. The Tongue River member is the chief coal-bearing formation in

in Southeastern Montana. Sandstone is the most conspicuous rock in this member with an excellent example being the "Medicine Rocks".

B. The Lebo shale member at the base of the Fort Union is 150-300 feet thick and weathers to a gumbo soil. This formation is found in the northeastern portion of the district. Its most distinguishing characteristics is its somber, drab color, the barron treeless surface, and the numerous zones of "iron stone" concretions.

Custer County -

The sedimentary rocks exposed in Custer County consist of strata laid down relatively late in geologic time. In general, the strata are nearly horizontal, consequently, lace rocks are commonly found along the valleys or major streams, and Fort Union rocks occur capping the highlands.

During most of Cretaceous time, thick sequences of marine strata were deposited in shallow seas occupying Eastern Montana. These compacted sediments are known as the Pierre shale and lie immediately below the Lance formation. Any water from deep wells in these shales is unsuitable for plant or animal use. The late Cretaceous marked the partial withdrawal of the seas, and thick, continental, coal-bearing sediments were deposited. A thick sandstone unit at the base of the Lance formation is known as the Fox Hills sandstone, and is an important aquifer in Southeastern Montana. The other prominent member of the Lance formation, the Hell Creek member, is composed mainly of shales, and is not an important source of groundwater Lying on top of the Lance is a thick sequence of alternative beds of shale and sandstone with occasional seams of coal. These strata are known as the Fort Union formation and were deposited during the Tertiary period about 50,000,000 years ago. The Fort Union is divided into an upper Tongue River member in which permeable zones are plentiful, and a lower Lebo shale member. The Tongue River member is an important source for groundwater while the Lebo shale is not considered an aquifer.

The alluvial deposits are an important source for shallow wells, especially along the main drainages.

The geologic structures of Custer County are relatively simple. The Powder River flows northward along the axis of a wide structural basin. The rocks dip gently toward the axis from the east and west. Because of this structure, surface flowing artesian wells can be obtained along several of the major drainages.

Fallon County -

The geologic history of Fallon County includes long periods of sedimentation with only minor interruption by uplift and erosion until the end of Cretaceous time (about 65 million years ago). At the end

of Cretaceous time, a period of major structural upheaval lifted a structure called the Cedar Creek Anticline, which trends northwesterly across the northeastern half of Fallon County. Subsequent erosion has exposed some older geologic formations along the crest of the anticline. After the period of major structural upheaval and erosion, sedimentation resumed and has continued to the present time.

The geologic formations most important to the water resources of Fallon County include alluvia of the Recent Age (less than 20 thousand years old); and the Hell Creek, Fox Hills and Pierre Formations of the Cretaceous Age (65 to 135 million years old).

The Fort Union Formation is exposed at the ground surface on the west side of the Cedar Creek Anticline and in the northeastern part of Fallon County along the east side of the anticline. The Fort Union Formation attains a maximum thickness of 500 - 600 feet in the county and consists of interlayered beds of shale siltstone, lignite coal, limestone, and discontinuous sandstones. Many relatively shallow water wells in Fallon County produce water from sandstone and coal beds in the Fort Union.

The Hell Creek Formation of Cretaceous Age which lies below the Fort Union, consists of about 200 feet of non-marine and brackish water sandstone, shale mudstone, and siltstone. The Hell Creek is exposed at the ground surface in a narrow band along the west flank of the Cedar Creek Anticline and in a broader band, about a township wide, on the east side of the anticline. Sandstones of the Hell Creek normally yield abundant quantities of soft water for stock and domestic use. Locally, the water may be highly mineralized.

The Fox Hill Formation of Cretaceous Age lies below the Hell Creek Formation. The Fox Hill Formation is exposed at the ground surface as two narrow parallel bands along the crest of 100 - 150 feet of marine and brackish water deposits of cross-bedded sandstone, siltstone and shale. Generally, adequate supplies of good to fair quality water for stock and domestic use can be obtained from the Colgate and from sandstones of the overlaying Hell Creek formations. This water is probably too highly mineralized for general irrigation use.

The Pierre Formation of the Cretaceous Age, which lies below the Fox Hill Formation, consists of 1,500 - 2,000 feet of dark, dense, marine shale and limestone. The Pierre is exposed at the ground surface along the crest of the Cedar Creek anticline and is not a good source of groundwater in Fallon County.

Powder River County -

The geological history of Powder River County includes long periods of sedimentation and erosion. Geologically, the county is on the western edge of the Black Hills uplife and the eastern edge of the

Powder River Basin. The occurrence, movement, and quality of groundwater in the county is closely related to geological conditions. Formations of importance to the county's groundwater resources are the Lance Formation of Cretaceous Age (65 to 135 million years old), the Fort Union Formation of Tertiary Age (one to 65 million years old) and the terrace alluvial deposits of Quaternary Age (less than one million years old).

The Fox Hills member occurs as a basal member of the Lance Formation. The Fox Hills usually consists of layers of thick sandstone and sandy shale. In Powder River County there are good aquifers in overlying formations; consequently, the Fox Hills is of less importance. The thickness of the Fox Hills in the area is approximately 80 feet.

Overlying the Fox Hills member is the Hell Creek member. The Hell Creek consists of about 600 feet of sandstone and shale with some thin coal seams. Sandstone layers will yield water to wells, with the lower part of the Hell Creek reported to have higher artesian heads and better yields than the upper part. The contacts of the Hell Creek with the underlying Fox Hills member and the overlying Fort Union member are not distinct. Sandstone layers within the Hell Creek are discontinuous and cannot be traced over long distances. Groundwater is present in the Hell Creek in amounts adequate for stock and domestic purposes and is of fair to poor quality. In the Powder and Little Powder River valleys artesian wells, many which flow, are common.

Overlying the Hell Creek is the Fort Union Formation which consists of the Tongue River member and the Lebo Shale member. The Lebo Shale consists of dark grey gumbo shales with impure sandstones. The Lebo Shale member ranges from 150 - 200 feet in thickness. Water yields are low and of poor quality.

The Tongue River member of the Fort Union Formation is exposed primarily to the west of the Powder River. This member consists of beds of sandstones and grey shales with many coal seams. Due to erosion, the Tongue River becomes thinner along the Powder River and thickens to the west and south. Sandstone and coal beds in the Tongue River supply water to numerous wells in the county. Wells are usually 200 - 500 feet deep and yield four to 25 gallons per minute. The Tongue River member is probably the most widely used source of domestic and stock water in the county.

Along the Powder and Little Powder Rivers and their tributaries and other major streams there are deposits of Quaternary alluvium, and in some areas stream terrace deposits. Stream terraces are composed of sand and gravel and the thicker terraces may contain sufficient groundwater for stock and domestic use.

Alluvial deposits along the Powder and Little Powder Rivers consist primarily of sand and silt. Wells in this alluvium yield water but sand flowing into the wells has caused problems. The quality of the water is fair to poor. Where the stream valleys are underlain by shale, the

water tends to be poorer in quality than where bedrock is sandstone. Groundwater also is present in the alluvium of practically all other large streams in the county.

In summary, sandstone layers in the Hell Creek and Fort Union members, and to a lesser extent alluvium along streams are the most important sources of domestic and stock water in Powder River County. Development of groundwater for livestock and to a lesser extent for domestic purposes will continue. There may be some additional development for municipal purposes, but the county has few areas where water can be developed from irrigation.

Rosebud County -

As with the surrounding areas, Rosebud County has rock of sedimentary origin. They range in age from Cretaceous (approximately 100 million years old) to recent (less than 20 thousand years old). The geological history of Rosebud County includes long periods of sedimentation followed by erosion and regional uplift.

During the Cretaceous, thick sequences of marine sediments were deposited in a shallow sea which covered most of Eastern and Central Montana at that time. As the sea advanced and retreated, it alternately deposited shales and sandstones. As the sea advanced, a thick sequence of marine shales known as the Colorado group was deposited. As the sea retreated, it then deposited a sandier unit known as the Eagle Formation. As the sea continued to fluctuate, it deposited the shales of the Clagget Formation, the sandstones of the Judith River Formation and finally a thick blanket of dark shales belonging to the Bearpaw shale.

The beginning of the Tertiary marked the deposition of the thick continental deposits of sandstones, shales, clays, and coal. These deposits make up the Lance Formation and members of the Fort Union Formation.

Quaternary deposits of terrace materials and alluvium are found in the lowlands and along the Yellowstone River and its tributaries.

The sedimentary strata in central and southern Rosebud County are relatively flat-lying. In the northern part of the county, a dome-shaped uplift which occurred after the deposition of the Fort Union Formation has tilted the beds away from its center forming Porcupine Dome. A maximum dip of 10 degrees has been observed on the east flank of the dome.

Groundwater occurrance and distribution in Rosebud County is directly affected by the geology.

Treasure County -

The geologic history of Treasure County includes long periods of

sedimentation and erosion. All of the rocks exposed at the surface are of sedimentary origin. They range in age from Cretaceous (approximately 100 million years old) to recent (less than 20 thousand years old).

During the Cretaceous, thick sequences of marine sediments were deposited in a shallow sea which covered most of Eastern and Central Montana at that time. As the sea advanced, thick sequences of shales underlying the Judith River Formation were deposited. As the sea retreated, the sandier sediments of the Judith River Formation were deposited. The last advance of the sea laid down thick, shaley, marine deposits known as the Bearpaw shale.

Following the Cretaceous, thick continental deposits of sandstones, clays, shales and coal were deposited. These deposits make up the various members of the Lance and Fort Union Formations.

Quaternary alluvium, ranging from coarse gravel to silt, is found on the bottom lands and lower terraces in the valleys of the Yellowstone River and its tributaries.

The sedimentary rocks in Treasure County have a regional dip of a few degrees to the northeast. This general trend is interrupted in the eastern part of the county by westerly dipping rocks from the flanks of the Porcupine uplift in neighboring Rosebud County. The simple structure and the stratigraphy in Treasure County are favorable for artesian pressure. Few surface flowing wells have been developed along the valley of the Yellowstone River.

The occurrence and distribution of groundwater is directly related to the geology of the county. A description of the various geologic formations and the hydrologic characteristics of each are shown on the legend on the geology map which is available at the YTAPO office.

The geologic formations identified have unique geophysical and geochemical components. How they interact with the hydrologic cycle plays a significant role in determining the natural water quality of surface and groundwaters.

SOCIOECONOMIC

Historically, the six-county area has been oriented towards independent lifestyles that revolve around agriculture. Traditionally, these lifestyles have changed only gradually over long periods of time. With the rapid influx of workers associated with the development of energy related facilities, the lifestyle of the rancher/farmer will come under attack. A community of several thousand people which becomes the site of an energy related facility may acquire two to three times as many people as its original population. Changes will certainly occur in the social, political, and economic structure of the community.

But just how does coal development affect the area's major livelihood, agriculture? First, the stripmining will remove some land from production, usually a small percentage of the total area. The second and more important factor deals with the effects on groundwater and air pollution from generation plants affecting productivity of the land. The groundwater may suffer both in quantity and quality in areas adjacent to the mines.

The biggest impact on agriculture will be caused by the people brought to the area by the mining, not the mining itself.

The YTAPO has not expended funds on a socioeconomic survey and associated projections due to the proliferation of existing studies and the questionable validity of attempting to forecast for 20 years into the future in an area so susceptible to major changes.

As an example of the problems with population projections, a 1970 Water and Sewer Plan done by a major consulting firm indicates that the population of Rosebud County will decline from 5,500 (the official 1970 census indicated 6,120 people) in 1970 to 4,800 in 1990. An official census taken in January, 1976, indicated that the population was 9,570 and the Department of Community Affairs is currently projecting 12,000 for 1990. The same report wrote off th town of Colstrip with one phrase, "...the community of Colstrip was excluded as it is a privately owned company town." At that time Colstrip had 200 people. In January, 1976, there were 2,680 people, and some people think that it may surpass a population of 10,000 in in the future. Population projections for Rosebud County range from 43,500 to 48,000 by the year 2000. The most probable population will be in the range of 8,000 to 15,000.

As an alternative to the development of exact population projections, the YTAPO has summarized known population levels and reviewed the assorted projections for the area. (Table 1, Page 2). The projections of historic trends based on U.S. Census data is not intended to be a prediction of future population. They are for use for comparative purposes, as when evaluating the overall impact of development on the project area. The probable ranges of population for 1981 and 1996 were developed by the YTAPO on a qualitative basis. There is no specific formula or procedure that was followed.

ENERGY DEVELOPMENT

The amount of development related to the mining and/or on-site-conversion of coal reserves has made significant impressions on the social and economic framework of Southeastern Montana.

Vast reserves of strippable coal lie beneath large areas within or adjacent to the YTAPO project area. Increasing pressures from an energy hungry country are demanding development of these reserves. This coal, a part of the Fort Union Formation, is considered particularly attractive because of its ease of mining, favorable BTU rating and its low sulfur, moisture, and ash content.

Currently within the YTAPO area three strip mines are in operation: Big Sky Mine--Peabody Coal 2; Colstrip Mine--Western Energy; and the Coal Creek Mine. All are within southcentral Rosebud County. Production from these mines is mostly exported by rail except for the small operation at Coal Creek which is done by truck.

At Colstrip, two 330-megawatt coal-fired steam generating plants are currently on line. These units burn coal mined by Western Energy. In addition, two electric generating plants have been tentatively approved at Colstrip. These are known as Colstrip Units 3 and 4 and are designed to produce 700 megawatts each. The actual construction has begun though final clearance from litigation has not been resolved.

It can be assumed that the likelihood of additional power plants or conversion facilities being constructed will meet a great deal of resistance. Plagued with lengthy permit and approval procedures, and escalating construction costs, rapid or high level development projections seem unlikely. However, it should be remembered the state and, in particular, the YTAPO area will continue to be scrutinized by energy development interests because of its vast storehouse of coal in the years to come. The exact amount of pressure that will be exerted will ultimately be contingent on the energy needs of the populated portions of the country.

The state, though no official policy has been declared at this time, will maintain a strong stand on protecting its environment and its 30% export tax on coal produced within the state.

A suit recently filed by the Decker Coal Company, Commonwealth Edison of Chicago, Detroit Edison, the City of Austin, Texas, and the Lower Colorado River Authority, challenges the state's 30 percent tax. These utilities claim the tax is unconstitutional by violating the Interstate Commerce Clause of the Constitution. This action could tie up Montana's coal tax revenue for several years while the matter is settled in the courts.

The potential for water quality degradation directly or indirectly

related to coal development in the form of strip mining and/or energy conversion facilities is enormous.

Many possible water pollution related problems have been identified. These include degradation of ground and surface waters due to leaching of salts from spoil piles, increased sedimentation due to runoff from disturbed lands and those stresses placed on water by increased population. Considerable efforts have been made to determine existing natural conditions of both surface and groundwater quality and to project the impacts caused by energy development. A great deal of research has been performed to date, yet in certain areas, results remain inconclusive. Land reclamation techniques continue to be evaluated and their impacts on water quality evaluated. On an adjacent front, various coal conversion processes continue to be evaluated to estimate their impact on water quality.

It is too early to accurately assess either short or long term consequences of energy related development on the water resources with the project area. However, it appears certain that with the strict regulations that are now applicable to such development, the impacts will be significantly minimized.

NORTH CENTRAL POWER STUDY

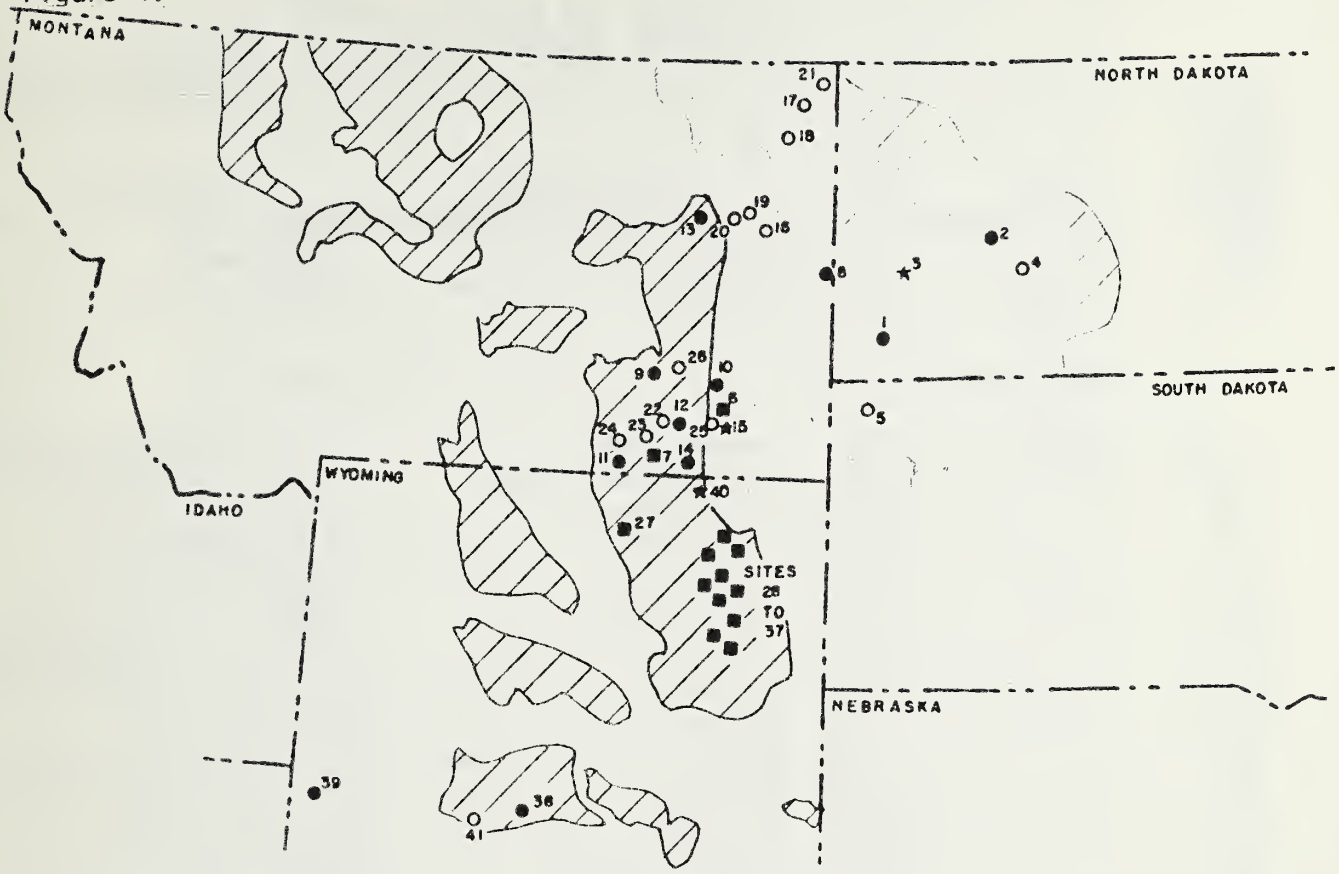
Exhaustive efforts have been conducted by various individuals and agencies trying to accurately predict future energy development in South-central and Southeastern Montana -- an area also known as the Northern Powder River Basin.

One of the first studies conducted, the North Central Power Study, was initiated by major power utilities located in the Northcentral United States. It was established in 1970 to investigate the power needs and resources for the area through the year 2000. The study, released one year later, proposed 41 potential power plants for the Fort Union coal region. (Figure 4).

This study became the center of controversy when it was released to the public. Many people became concerned with the effects possible from energy development. Today, this study is not considered an accurate picture of probable development.

Figure 5 shows the Northern Great Plains' most probable level of development. The map includes the Decker and Sarpy Creek areas which are just a few miles upstream from the borders of the YTAPO. Potential development on the Northern Cheyenne Indian Reservation is not included.

Figure 4.



LEGEND
PLANT SIZE IN MEGAWATTS
■ 10,000
● 5,000
★ 3,000
○ 1,000
42 IDENTIFICATION NUMBERS

SUB-BITUMINOUS COAL
LIGNITE COAL

Potential minemouth power plant sites.

"North Central Power Study"

Figure 4, cont.

STRIPPABLE COAL SITES FOR 1,000 MW OR MORE
BASE LOAD MINE-MOUTH GENERATING PLANTS 1/

Site Identification Number	State	Plant Size MW	Deposit Name	Location
1	North Dakota	5,000	Slope & Bowman Counties	Bowman, N.D.
2	" "	5,000	Knife River	Beulah, N.D.
3	" "	3,000	Heart River	Dickinson, N.D.
4	" "	1,000	Center	Center, N.D.
5	South Dakota	1,000	Cave Hills	Ludlow, S.D.
6*	Montana 2/	10,000	Pumpkin Creek	20 m. N.W. Broadus, Mont.
7*	"	10,000	Hanging Woman Creek	10 m. S. Birney, Mont.
8	"	5,000	Beach-Wibaux	Wibaux, Mont.
9*	"	5,000	Colstrip	Colstrip, Mont.
10*	"	5,000	Foster Creek	Volborg, Mont.
11	"	5,000	Decker	Decker, Mont.
12*	"	5,000	Otter Creek	10 m. S.E. Ashland, Mont.
13*	"	5,000	"S" Bed	10 m. N.W. Brockway, Mont.
14*	"	5,000	Moorhead	Moorhead, Mont.
15*	"	3,000	Broadus	Broadus, Mont.
16	"	1,000	North Fork of 13 Mile Cr.	25 m. N.W. Savage, Mont.
17	"	1,000	Reserve	Reserve, Mont.
18	"	1,000	Fort Kipp	Fort Kipp, Mont.
19	"	1,000	Lane	Richey, Mont.
20	"	1,000	Carroll	Paxton, Mont.
21	"	1,000	Coalridge	Coalridge, Mont.
22*	"	1,000	Poker Jim - Lookout	Birney, Mont.
23*	"	1,000	Birney	Birney, Mont.
24*	"	1,000	Kirby	Kirby, Mont.
25*	"	1,000	Sonnette	Sonnette, Mont.
26*	"	1,000	Sweeney Creek	10 m. N.W. Brandenberg, Mont.
27	Wyoming	10,000	Lake De Smet	10 m. N. Buffalo, Wyo.
28 thru 37	"	10,000 ea. (100,000 mw total)	Gillette	15 miles N. of Gillette to Antelope Creek (55 miles S. of Gillette, Wyoming)
38	"	5,000	Red Desert-Cherokee	N. of Wamsutter, Wyo.
39	"	5,000	Adaville	6 m. W. of Kemmerer, Wyo.
40	"	3,000	Spotted Horse	Spotted Horse
41	"	1,000	Jim Bridger	25 m. N.E. Rock Springs, Wyo.

1/ Based on: (1) 80% recovery, (2) 9,400 Heat Rate, (3) 35-year life at 85% plant capacity factor.

2/ In addition, Montana has other probable, but not yet identifiable, sites on Northern Cheyenne and Crow Indian Reservations.

* Projects within the YTAPO area.

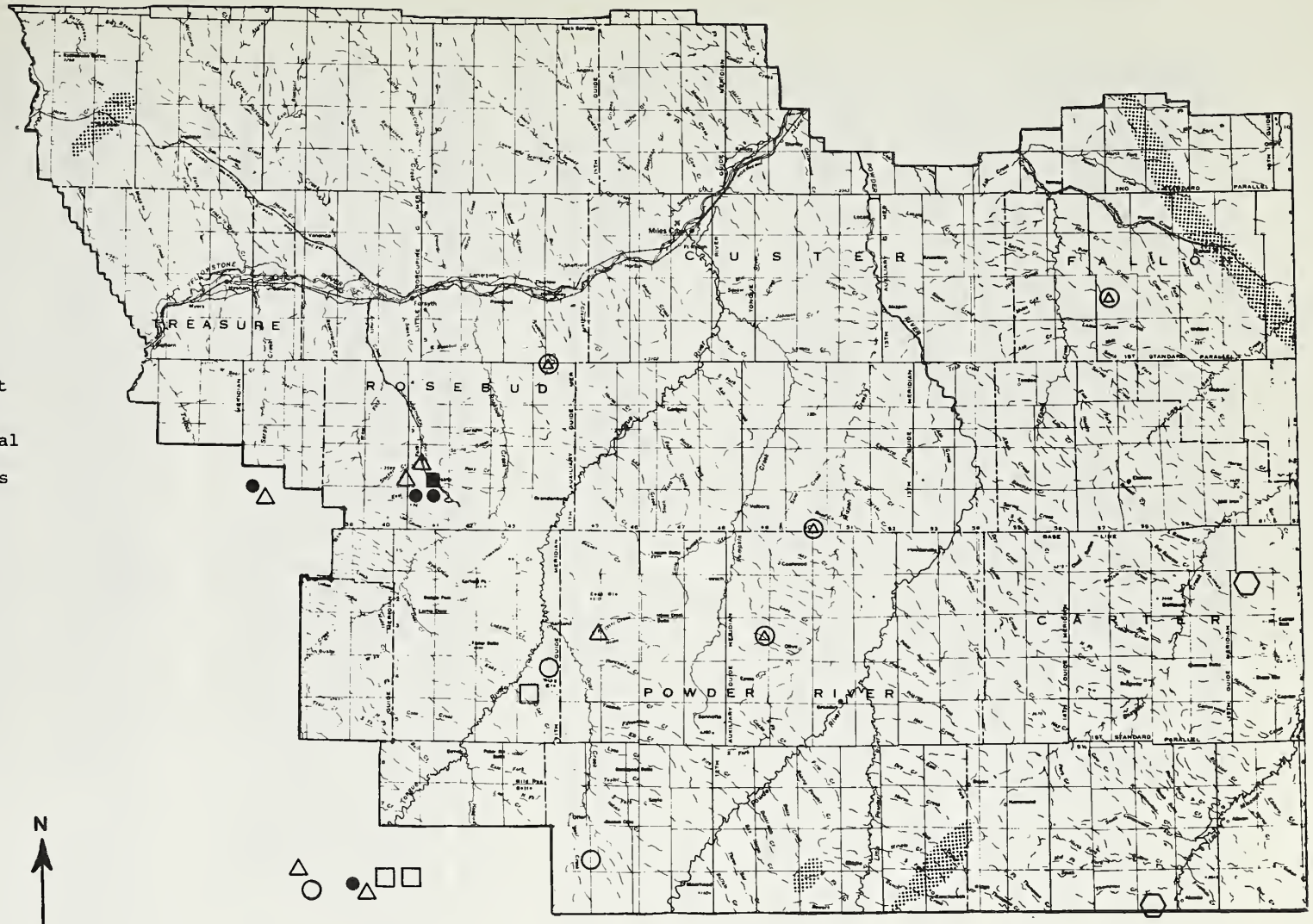
Figure 5

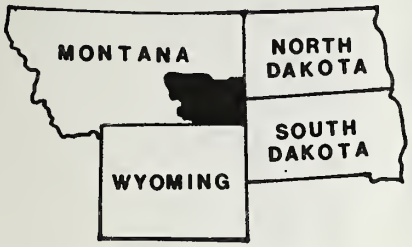
MOST PROBABLE LEVEL
OF DEVELOPMENT BY 1985

- ● Existing mine
- ■ Existing power plant
- ▒ Existing oil fields

NGP Most Probable Development:
- ○ Export mine
- □ Power plant
- △ Gasification

Supplemental YTAPO Projections:
- ⊙ Export mine
- ⬡ Uranium





N

scale:
one inch equals sixteen miles

YELLOWSTONE-TONGUE A.P.O.

Funded by an E.P.A. section 208 grant

1976

NORTHERN GREAT PLAINS RESEARCH PROJECT

One of the best known sources of information is compiled by the Northern Great Plains Research Program. This project is a joint effort of the States of Montana, Wyoming, Nebraska, North Dakota, South Dakota, the Department of Interior, Department of Agriculture and the Environmental Protection Agency. Their projections of energy development tend to be clustered near and along the Tongue River. With the new stripmining law recently passed by Congress imposing strict limitations on mining on alluvial plains, the NGPRP projections may become obsolete. The proposed development may move out of the Tongue River valley and up to the rangeland west of Broadus.

The NGPRP projections for gasification plants seem to be high. Currently, gasification plants are farther behind in development but this may change in the next few years. The projections do give planners some idea of what may happen in the future.

HARZA STUDY

This study was proposed by the Harza Engineering Company for the Missouri River Basin Commission's Yellowstone Level "B" Study. This is another study that estimates energy related demands for water, land, capital, labor, and coal resources in the Yellowstone River Basin.

The Harza Report formulates several levels of development which could occur in the coal area of Southeastern Montana. The low level of development has most of the coal being exported by rail. Currently, most of the coal mined in this area is shipped out of the area by rail. The Study's high level of development combines coal export by rail with gasification plants and coal slurry pipelines -- two developments bound to cause controversy. However, the Study makes a series of assumptions which they consider most likely to happen. Because no one can look into the future, some people may envision different assumptions and challenge the values they used.

The Harza Study was put together during the past Ford Administration which had a different energy policy from the present administration. This certainly will affect the predictions made in the Study.

NORTHERN POWDER RIVER BASIN ENVIRONMENTAL IMPACT STATEMENT

Perhaps the best prediction to date will be available shortly after the completion of this project; that generated by the interagency task force comprising the Northern Powder River Basin Environmental Impact Statement team. It has been their goal to

contact individuals and corporate structures interested in developing the energy reserves within the basin in an attempt to document the location and intensity of their interests. Several areas are being considered by numerous entities within or immediately adjacent to the YTAPO project area. Several proposals for new strip mines have been revealed. Generally, these are in portions of Southcentral Rosebud, the extreme southeastern portion of Custer and the western half of Powder River Counties. The size and timing for the opening of these mines is extremely speculative in most cases. In addition to lengthy permit/application procedures, transportation networks (railroads) are absent thus making economics of the situation extremely high. It is assumed by most of those individuals involved with these projections that eventually a transportation network will open the area, thus, opening the door for the development of several of these proposed mines. It appears that the Burlington Northern has been asked to prepare an engineering feasibility study by one development interest connecting the spur line serving Colstrip with a proposed mine site south of Ashland. It is assumed, because of potential difficulties working with the Northern Cheyennes, that this line will pass to the north of the reservation, cross the Tongue River, then proceed south. Should this line be constructed, economic feasibility for other similar developments will be bolstered significantly.

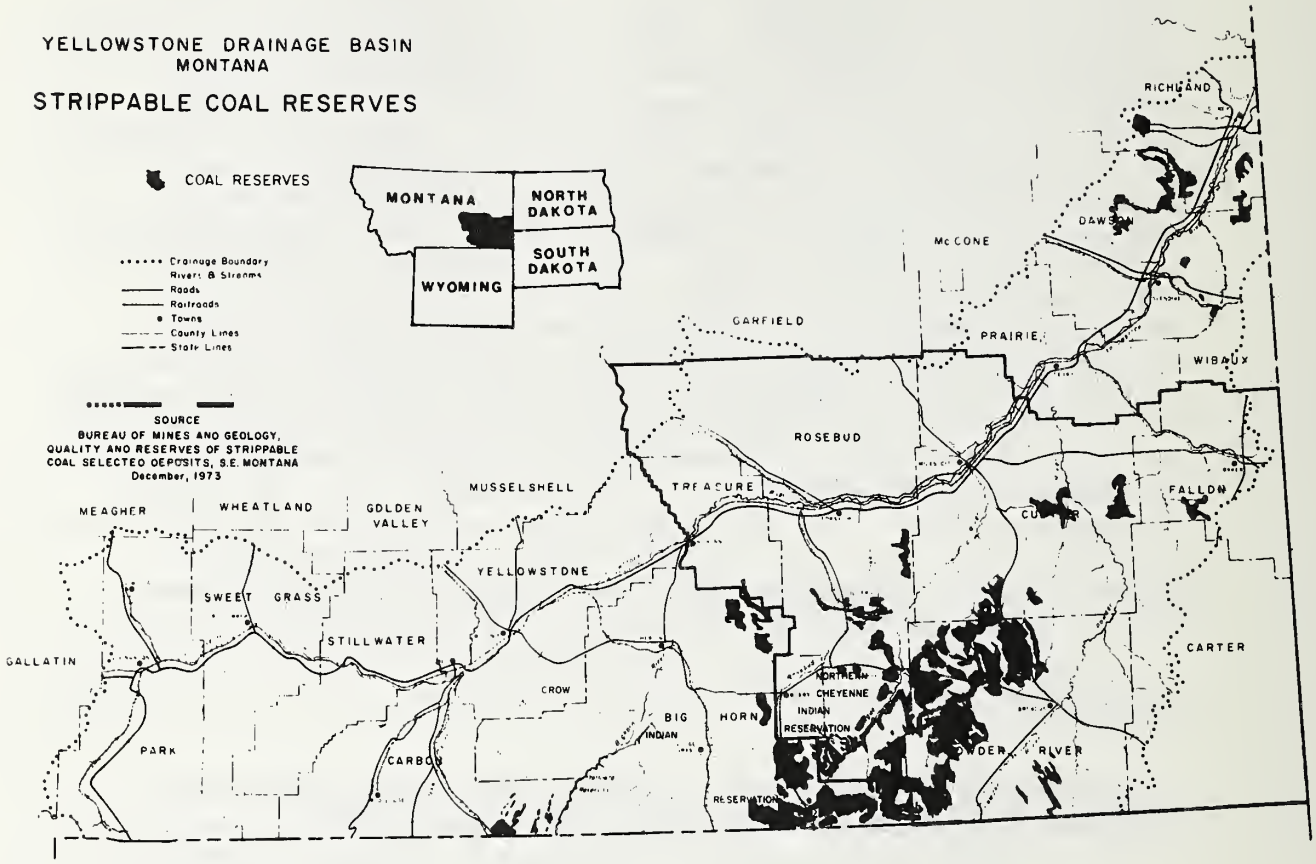
PROJECTIONS

The material just covered indicates the varying degrees of development which could occur within the project area.

It is the current opinion of the YTAPO staff that it is not possible to provide accurate population projections for the southeastern part of Montana due to the lack of knowledge of extent and rapidity of private energy development. All population projections for the Project area must be taken with the thought that the person or firm who did the projections made many assumptions, some probably erroneous.

While most people might expect that the primary effort of the YTAPO be directed toward the direct impacts of the proposed surface mining operations, this has not been a major part of the project. The primary rationale being that since several million dollars and many years have already been spent on surface mining and its effects on the environment, there was relatively little we could do within our budgetary and time constraints. Much of the YTAPO's effort has been directed toward the "secondary" effects of mining -- the impact caused by the construction and the influx of people.

On a short-term basis, the construction of roads and energy related facilities along with the wastes generated by the people required to build such facilities, will have a greater impact on water quality than the actual act of mining. Since it is not possible to predict the location and time of development of new energy projects with any accuracy, the projection of "secondary" impacts is equally difficult.



The YTAPO Includes the Area Indicated on the Index Map and Outlined in Black on the Larger Map.

COORDINATION WITH OTHER PROGRAMS

The potential for coal extraction and conversion has stimulated dozens of studies within the YTAPO project area. The Yellowstone Basin and Adjacent Coal Area Level B Study and the report on "The Future of the Yellowstone River?" by the Department of Natural Resources and Conservation are studies directly related to this report. Copies of these studies will be appended to the final management plan.

All other relevant studies are listed in the supportive materials, in the section on "Coordination with Other Programs" or the bibliography.

COMPLETED STUDIES

Recently completed studies which the YTAPO has drawn heavily upon include:

The "Water Quality Inventory and Management Plans" developed by the State of Montana under Section 303e of the Clean Water Act Amendments. These reports were completed for the Middle Yellowstone, Lower Yellowstone, and Little Missouri River Basins.

The "Draft EIS on Colstrip Electric Generating Units 3 and 4 and Associated Facilities" prepared by the Department of Natural Resources and Conservation.

The various reports of the Northern Great Plains Resource Program. This Program published a large number of reports on topics ranging from water quality to the social and economic impacts of development. Several of their maps also proved useful.

The "Comprehensive Area-wide Water and Sewer Plans" published by the Department of Natural Resources and Conservation.

Older reports which proved interesting include:

"Sedimentation and Chemical Quality of Water in the Powder River Drainage Basin of Wyoming and Montana" published by the U. S. Geological Survey in 1952.

The report on the expedition by Captain W. F. Raynolds through the Powder River area in 1859.

CURRENT STUDIES AND PROGRAMS

The YTAPO has attempted to keep track of all related studies and programs currently in progress.

Several programs related to the YTAPO are summarized on the following pages.

YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY

The Level B Study has been in progress for approximately the same time span as the YTAPO program. There has been quite a bit of interaction between the two programs, but the goals are noticeably different. The Missouri River Basin Comprehensive Framework Study (which is related to the Level B Study) stated that the principal planning objectives for the Yellowstone Basin were to "intensify agricultural production and the processing of agricultural products, development of industrial processing of coal and expansion of the recreation and tourist industry." Many agencies are concerned that the Level B Study is primarily oriented toward providing water for development.

The Level B Study will result in a series of plans with slightly different objectives -- national economic development, state/regional development, and environmental quality. The Recommended Plan will be a selection of those components of the three basic plans which will meet the needs identified by the Level B Study.

Much of the data collected by the Level B Study has been utilized by the YTAPO. A copy of their report on the Tongue and Powder River Basins is appended to this report. A study funded by the Level B Study, the Harza Report, has also been useful.

CONFLICTS/SUPPORT

The major conflict appears to be Level B's tendency toward development -- which usually cannot occur without some degree of negative impact on water quality. This would be especially true if the Study recommends use of higher quality waters for industrial consumption and/or coal transport. The YTAPO has taken the position, if at all possible, that the lower quality water should be utilized for industrial export or consumptive processes. If the "good" tributaries of the Powder River are diverted, the remaining water will be significantly degraded.

A secondary conflict may arise as people utilize the study data, believing it to be totally factual and not realizing the massive assumptions that were utilized in generating the results of the Harza Report. Another assumption that is questionable is, most land has received "adequate conservation treatment."

The major supportive item appears to be Level B's attempt to develop an "Environmental Quality" plan. The Level B people did face some problems in developing this portion of their report as several agencies were hesitant to give their "blessing" to what they anticipated to be a developmental plan.

The YTAPO has referenced many of Level B's projections and their social and economic evaluations since the YTAPO attempts to satisfy EPA's requirements for such data.

WATER RIGHTS

Water law within the State of Montana is based upon the Prior Appropriation Doctrine. The right to use water from streams or rivers is based upon the application of water to beneficial use. Prior to July 1, 1973, diversion and use was the only necessary requirement to establish a right to surface waters, except on an adjudicated stream. Under the new water law, a permit must be obtained for the use of any water.

The process of adjudication has been started on the Powder River and has been proposed for the Tongue, Bighorn, Clark's Fork and Yellowstone Rivers. The quantification of existing water rights will not be possible until this adjudication process has been completed.

The water rights situation is further complicated by:

A. A system for establishing reservations for future water use by any unit of government. Conservation Districts have requested reservations for agricultural purposes, the Water Quality Bureau and Department of Fish and Game have requested water for the maintenance of instream flows.

B. The Yellowstone River Compact which allocated the waters of the interstate tributaries to the Yellowstone River between the States of Montana and Wyoming.

C. The Winters Doctrine, which holds that when the Indians ceded their lands to the USA, water was reserved for use on those tracts of land that were then reserved for use by the Indians. The amount of water the Northern Cheyennes are entitled to has not yet been determined by the courts. The same concept applies to all federal lands held in reserve for the public.

Additional information can be found in, "The Future of the Yellowstone River....?" which is appended to this management plan.

There is apparently still a legal question concerning the implications of water rights relative to water quality. Water rights have been historically linked to the quantity of water required for certain uses. With the exception of a 1902 Court Case (Helena vs Rogan), there have been few references to whether or not a water right also guarantees the holder of the right to a certain quality of water.

A recent memo from the Chief Legal Counsel of the Montana Department of Natural Resources and Conservation contained the following:

"I should point out that water quality can be a part of a water right. There are cases in other jurisdictions that support that proposition. Therefore, if an objector alleges an adverse affect on the quality of the water used for his water right, we should entertain such objection. There is even a Federal District Court case out of Colorado (United States v. 508.88 Acres of Land, et al.) which held that a water right holder can be entitled to dirty water if such holder relies on the sediment to line his ditches. If the water rights staff runs into a water quality - water right assertion, they should consult the legal staff for advice on how to proceed."

This appears to indicate a trend to include water quality as part of a water right. The YTAPO supports such a trend and will encourage the introduction of a bill during the next legislature which clarifies the connection between water rights and water quality.

The relationship between water rights and water quality appears even more vague when applied to interstate situations. The Yellowstone River Compact guarantees Montana a certain percentage of the flow of the Tongue and Powder Rivers (Table 13) but does not indicate whether Montana is entitled to water of "usable" quality. This could be critical on the Powder River as the selective diversion of the better water in Wyoming could make the water remaining in the Powder River unsuitable for most uses due to elevated salinity levels.

Table 13. Division of water under the Yellowstone River Compact

Tributary	Wyoming	Montana
Clark's Fork	60%	40%
Bighorn	80%	20%
Tongue	40%	60%
Powder	42%	58%

CONFLICTS/SUPPORT

There does not appear to be any direct conflicts between water rights and the YTAPO program. The lack of a specific link between water rights and water quality might be considered to be an indirect conflict. Any attempt to pass legislation guaranteeing adequate water quality to those holding prior water rights will undoubtedly be met with opposition under the guise of interference with the traditional concept of water rights. In a sense this is an extension of the conflict between senior and junior

appropriators. A link between water quality and water rights would benefit those holding existing rights and might make it more difficult for those wishing to use water in the future.

Recent actions within the Department of Natural Resources and Conservation appear to be supportive of water quality.

AIR QUALITY MAINTENANCE AREAS

The Air Quality Bureau of the Department of Health and Environmental Sciences is engaged in developing a state-wide implementation program to attain and maintain the National Ambient Air Standards. The borders of the Southeastern Montana Coal Area - Air Quality Maintenance Area, coincides with the planning boundaries of the YTAPO.

The YTAPO assisted the representative from the Air Quality Bureau in establishing contact with local elected officials and has provided the Bureau with supportive materials and recommendations.

Originally, the entire area was classified under Class II standards. The Northern Cheyenne applied for and received a Class I air quality designation. This has become controversial since the Class I designation for the Reservation could restrict the development of the surrounding area, especially as related to coal conversion facilities. The SO_2 emissions from the proposed Colstrip Units 3 and 4 would violate this designation if constructed as currently designed. A Federal Court has ruled that Units 3 and 4 are "grandfathered", i.e., started prior to the establishment of the more restrictive air quality standards for the Reservation. This decision is being appealed.

CONFLICT/SUPPORT

The primary conflict between the air quality program and the YTAPO is that one form of residual waste is being changed to another form of residual waste. The materials that are taken from power plant emmissions are normally converted to a sludge and buried. This may cause a nonpoint source pollution problem that will plague the area for many years. Other conflicts occur when the recommended control measures include the application of chemicals to the ground, such as the use of oil to control road dust or the use of herbicides as a substitute for controlled burning. Properly handled, the chemicals may not present a quantifiable problem, but sloppy procedures combined with a close proximity to drainage ditches and a possible thunderstorm may allow significant quantities of materials to enter a stream. Even the use of water for dust control may present an occasional problem due to the runoff or the dewatering of a stream or groundwater source.

Many air quality and water quality practices are supportive of each other. Most of the Best Management Practices the YTAPO is recommending for dryland farming will reduce wind erosion. Street sweeping to reduce the amount of contaminants in urban runoff will also reduce airborne particulate matter. The correction of wastewater treatment problems in communities such as Forsyth and Miles City will reduce nuisance odor problems.

LOCAL AND REGIONAL PLANNING

There is no regional planning organization with the duties and authority normally exercised by a Council of Governments or similar agency. An attempt was made to establish such an organization several years ago, but it met with much local political opposition. The title of the Yellowstone-Tongue Areawide Planning Organization implies that the YTAPO is such an organization, but the bylaws of the YTAPO provide that it work only on water quality related projects. It was established specifically to work with the "208" program.

Some studies of a regional nature have been completed by state and federal agencies. Examples are: The Yellowstone Basin and Adjacent Coal Area Level B Study, and the air quality and solid waste studies sponsored by the Montana Department of Health and Environmental Sciences.

Each county has a Planning Board; four counties have contracted for professional assistance. The YTAPO has received excellent cooperation from the professional planners.

Three of the local units of government have received HUD 701 funding for planning purposes. Miles City and Baker have developed comprehensive plans. Miles City has received additional funding to revise portions of their plan. Rosebud County has completed portions of a comprehensive plan.

Rosebud County has also utilized Coal Tax funds to do resource mapping and inventory analysis for the Ashland/Colstrip vicinity. The YTAPO had considered doing a soil suitability map for a portion of this area but dropped the project when Rosebud County received the funding to do the more comprehensive mapping.

The YTAPO did develop soil suitability maps for the areas adjacent to Miles City and Broadus.

CONFLICTS/SUPPORT

There have not been any obvious conflicts between the local planning efforts and the YTAPO.

There are several areas where the YTAPO has supported the local planners -- including the development of land use maps and soil suitability maps. The local planners have been very helpful by providing professional support and assisting the YTAPO with collecting data and establishing contacts on a local basis.

BUREAU OF LAND MANAGEMENT AND U.S. FOREST SERVICE PLANNING

The Bureau of Land Management and the U.S. Forest Service control large acreages within the YTAPO area. The BLM also has responsibility for the development of federal minerals. Since the surface ownership and the ownership of the mineral rights often differ, BLM decisions may influence the use of private lands.

The BLM is currently involved in several planning efforts, including Unit Resource Analysis and Management Framework Plan and the Northern Powder River Basin EIS Team.

The BLM has been utilizing land use maps and groundwater information prepared by the YTAPO in their Unit Resource Analysis work and as part of their effort on the EIS.

The Sioux District of the Custer National Forest has prepared a multiple use plan. The Ashland District is in the process of developing a draft EIS on their proposed management practices. Both Districts have established an off-the-road vehicle policy.

An area of active cooperation between the two agencies was the establishment of procedures for plugging exploratory drill holes. The USFS appears to have had good results to date and the YTAPO is attempting to transfer some of these practices to drilling done on private land.

Both the BLM and USFS provided a cooperative atmosphere for interaction and information acquisition.

CONFLICT/SUPPORT

There are no areas of major conflict between the YTAPO and the BLM or the USFS.

Minor conflicts may arise due to policy differences, such as the YTAPO's recommendation to further restrict off-the-road vehicle traffic and to close and reclaim some unimportant trails.

Most of the land management practices utilized by the two agencies are supportive of the goals of the YTAPO. Both agencies are also sponsoring studies to further refine their land and minerals management programs.

NORTHERN POWDER RIVER BASIN ENVIRONMENTAL IMPACT STATEMENT

The U.S. Department of Interior has taken the lead role in the preparation of a regional environmental impact statement concerning coal development in Southeastern Montana. The U. S. Geological Survey and the Bureau of Land Management are the primary federal participants. The State of Montana has a group attached to the Governor's office which has been actively involved with this project.

The draft EIS is anticipated to be ready early in 1978. At that time, data in specific energy proposals and the impact of mining on the groundwater will be incorporated into the YTAPO management plan.

The NPRBEIS has relied upon the YTAPO for general assistance and land use maps. In turn, their staff members have been of assistance whenever requested.

CONFLICT/SUPPORT

There are no apparent areas of major conflict between the YTAPO and the NPRBEIS. Minor conflicts may arise when the YTAPO has an opportunity to review the draft EIS.

Most efforts of the NPRBEIS should be supportive of the goals of the YTAPO. Their EIS process should uncover any major impacts of the proposed mining activities on water quality. Such impacts can then be eliminated or moderated.

Recent conversations with members of the NPRBEIS have indicated the possibility that a true "regional" EIS may not be completed. As a result, information on the cumulative impact of mining on water quality, especially in the Tongue River Basin, may not be available. The lack of a regional or river basin study related to this weakens both the NPRBEIS and YTAPO programs.

CITIZEN ORGANIZATIONS

Very few organizations within the YTAPO project area seem to be concerned about water quality. The Sierra Club, Isaac Walton League, and the League of Women Voters do not have active local chapters. The Northern Plains Resource Council has been active in environmental matters, but prefers to be considered an agricultural organization rather than an environmental organization.

The conservative political organizations appear to be much better organized locally than the environmental groups. The John Birch Society and the Farm Bureau are well established in most communities.

With the exception of the Carter County Sheep and Cattle Growers Association, few special interest groups have expressed concern about the YTAPO.

CONFLICTS/SUPPORT

Major conflicts are anticipated with both the environmentalists and the conservative political groups. The recommendations of the YTAPO will be too moderate to satisfy those who wish to limit coal development and, at the same time, will be too radical for those who oppose any additional regulations.

The conservative political groups tend to be opposed to additional government regulations, any form of regional government, and the Environmental Protection Agency. The YTAPO is associated with each of these undesirable elements.

Certain parts of the plan, such as the regulation of the solution mining for uranium will receive support from most groups. Other parts of the plan, such as the control of erosion or salinity from agricultural sources will be quite controversial.

WATER QUALITY

The quality of the streams and rivers within the YTAPO project area is quite variable. Table 14 indicates the high and low measurements of selected parameters as taken from EPA's computerized data storage (STORET) system.

Table 14. Minimum and Maximum values for selected parameters measured within the YTAPO area.

Dissolved solids	60 to 6430 mg/l
Total suspended solids	0 to 62,000 mg/l
Turbidity	0 to 20,000 JTU
Total nitrogen	.09 to 21.0 mg/l
Total phosphorus	.00 to 22.0 mg/l
Calcium	8.7 to 462 mg/l
Sodium	.00 to 1,300 mg/l
Sulfate	.00 to 4,000 mg/l
Bicarbonate	48 to 1,110 mg/l

The Yellowstone River has relatively good quality water, the Tongue River is of slightly lower quality, and the Powder River and most of the tributaries to the larger rivers are noticeably lower in quality.

It has been very difficult to separate the man-induced contaminants from the naturally occurring contaminants. This is especially true with sediment and salinity, the two "gross" pollutants. It is often possible to isolate the pollutant near its source - an irrigation return flow ditch or an eroding road fill. But once mixing has occurred, it is difficult to show that any one point or nonpoint source has increased the amount of a contaminant enough to be statistically significant. Figure _, which shows the average salinity of the Powder River by month helps illustrate this problem. The variation among samples within a month is so great that it would be difficult to show a statistically significant difference among the various months. Proving that a man-induced practice has caused a 2% or 5% increase in salinity during a given month would approach the impossible.

During the first few months of the project, the YTAPO considered sediment to be the most severe pollutant. Since then, the YTAPO has moved salinity to the number one spot. While sediment loads are high, especially on the Powder River, it is a very noticeable pollutant and one that can be removed by conventional treatment processes, if necessary. The salinity levels of many of the streams are high enough to make the water marginal for irrigation and, relative to the 1962 Public Health Service standards, unsuitable for drinking. The proposed National Secondary Drinking Water Regulations criteria for salinity is also exceeded by many streams and wells. Salinity is an insidious pollutant. It is not visible and it is expensive to remove.

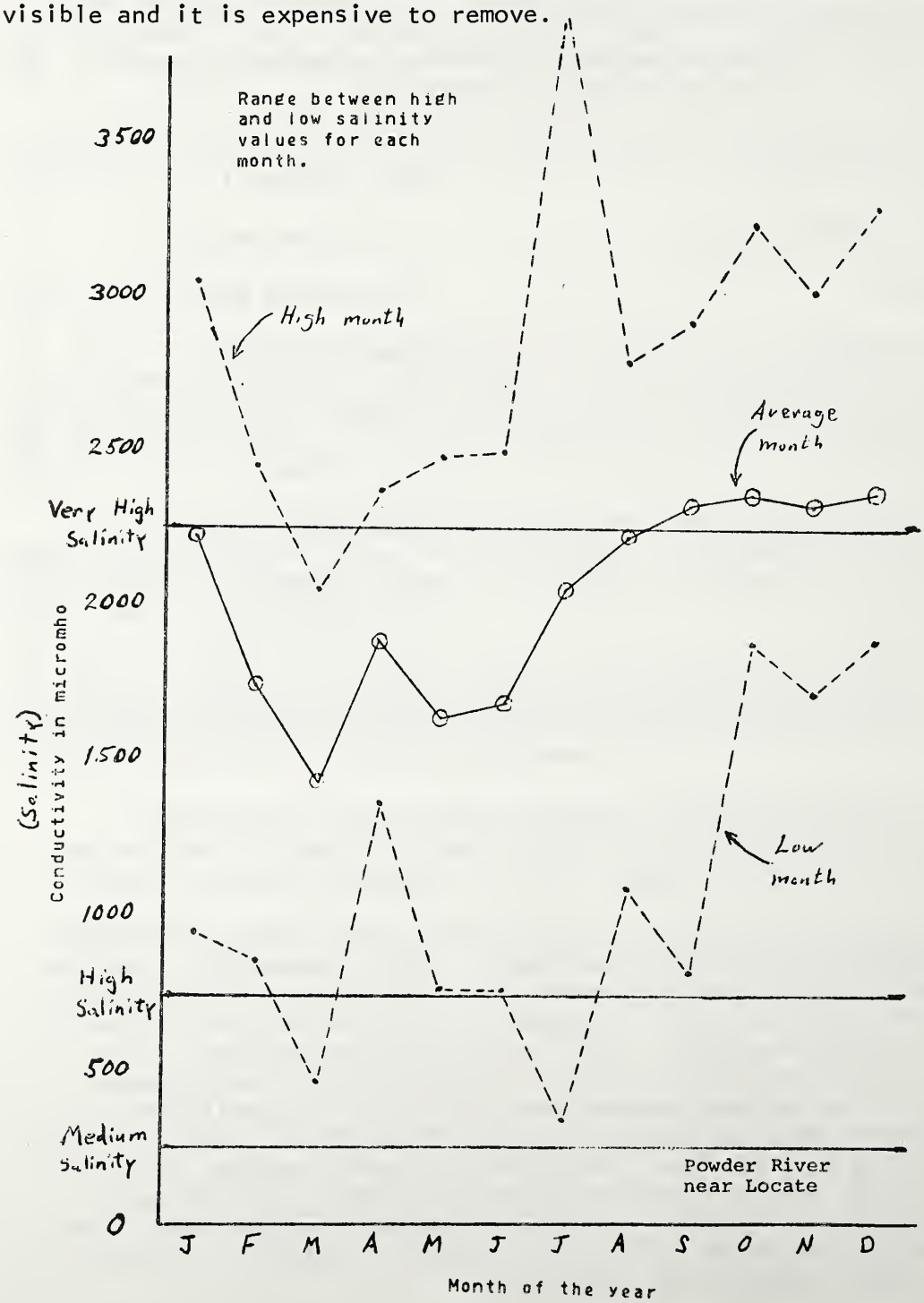


Figure . Salinity relationships on the Powder River.

The following narrative provides a summary of the quality of the water in the project area. Information on some of the tributary streams in Wyoming has been included because it is difficult to evaluate a river system along political boundaries.

YELLOWSTONE RIVER - LAUREL TO SIDNEY

This reach of the Yellowstone River has eight active water quality monitoring stations. Table 15 lists all except the Billings station. However, this station was included in the analysis.

Turbidity

Turbidity had an average increase from 20 JTU's at Laurel to 117 JTU's at Sidney. The biggest jump (about 40 JTU's) occurred between Miles City and Terry. This increase can be attributed primarily to the Powder River.

Suspended Solids

Suspended solids violated the proposed coal industry permits limit of 70 mg/l at all stations. Again, the largest increase (188 to 711 mg/l average) occurred between Miles City and Terry. It can be assumed that the Powder River is the largest contributor. From Terry to Sidney the suspended solids decreased from 711 to 372 mg/l.

Sulfate

Sulfate exceeded the criteria of 250 mg/l at five of the seven stations increasing at an average rate of 33 mg/l at Laurel to 194 mg/l at Sidney. The largest increase (81 to 154 mg/l) occurred between Huntley and Meyers and can be attributed to the Bighorn River.

Total Dissolved Solids

Total dissolved solids (TDS) followed a similar pattern to that of sulfate, exceeding 500 mg/l at five of the stations and increasing from 174 mg/l at Laurel to 464 mg/l at Sidney, with the largest increase occurring between Huntley and Meyers (119 mg/l increase). This increase can be attributed to the Bighorn River.

Nutrients

Both total nitrogen and total phosphate exceeded the criteria at all stations, with the station near Terry recording the highest average for both elements (1.2 mg/l for nitrogen and 0.38 mg/l for phosphate).

Fecal Coliform

Fecal coliform, where collected, was higher than standards at all stations with Huntley having the highest average (2008 col/100ml). This may be contributed to the Billings sewage treatment plant which was being upgraded during this period.

Metals

The metals that exceeded the criteria are total copper, dissolved iron, total iton, dissolved manganese, total manganese, total zinc, dissolved mercury and total mercury. Only total iron seemed to show a general increase from Laurel to Sidney. Two high dissolved mercury values, 3.00 ug/l at Forsyth and 4.60 ug/l at Sidney, were observed. There are no known point sources for mercury.

TRIBUTARIES TO THE YELLOWSTONE RIVER NEAR CONFLUENCE

Between Laurel and Sidney there are seven tributaries to the Yellowstone that are sampled on a regular basis (Data from five stations is reproduced in Table 16). The tributaries range from Fly Creek with a mean flow of 21 cfs to the Bighorn River (the largest tributary to the Yellowstone) which averaged 5319 cfs.

Turbidity

Turbidities ranged from an average of 20 JTU's at Armells Creek to 758 on the Powder River.

Suspended Solids

Suspended solids were collected at only two stations with 126 mg/l average on the Tongue River being the high value.

Sulfate

Sulfates varied from 241 mg/l average on the Tongue River to 1651 mg/l on Armells Creek.

Total Dissolved Solids

All stations exceeded the 500 mg/l criteria for TDS with Armells Creek having the highest average at 2832 mg/l.

Nutrients

The Powder River had the highest values for both Total Nitrogen and Phosphates at 2.2 mg/l and o.67 mg/l respectively.

Fecal Coliform

Fecal coliform is collected at only three stations with the Tongue River having the highest average at 221 col/100ml.

Metals

Total iron, manganese, zinc and mercury are the metals which violate their criteria most often. A high average of 49,257 ug/l total iron, 1008 ug/l manganese, and 251 ug/l zinc were all found on the Powder River. Mercury averaged 0.23 ug/l on Rosebud Creek.

Since the same parameters show very little change at Meyers, Forsyth and near Miles City on the Yellowstone, the tributaries Sarpy, Armells and Rosebud Creek appear to have little effect on the Yellowstone at this time. The tributaries, Bighorn and Powder River, appear to have the largest effect on the Yellowstone River -- the Bighorn, because of its large flow, and the Powder River, because of its high concentrations.

POWDER RIVER AND ITS TRIBUTARIES

Ten stations, four of which are on the main stem of the Powder River, were examined for this report. (Data from eight stations is reproduced in Table 17).

Turbidity

Turbidity on the main stem is high with the station at Arvada having the highest average (1665 JTU's). The station near Locate, the farthest downstream station, had an average of 758 JTU's. The tributaries generally had low turbidity averages, except for the Salt Creek station which averaged 1400 JTU's.

Suspended Solids

Suspended solids were analyzed at only three stations with the station at Moorhead having the highest average (1456 mg/l).

Chlorides

Chlorides were above the criteria of 250 mg/l at only two stations--one on the Powder at Arvada (270 mg/l) and the other near Sussex on Salt Creek (1152 mg/l).

Sulfates

Sulfates exceeded the limit of 250 mg/l at all but one station with the highest average (1642 mg/l) near Kaycee on the South Fork Powder River.

Flourides

Flourides with an average of 2.66 mg/l were a problem only near Sussex on Salt Creek.

Total Dissolved Solids

Total dissolved solids were high at all stations except for the station at Ucross on Piney Creek (308 mg/l). The highest value on the Powder was 2006 mg/l at Arvada, while its tributary, Salt Creek, had the highest tributary average (4277 mg/l).

Nutrients

Nutrients were high at most stations. The station at Arvada on the Powder River had only one analysis for total nitrogen, however, that value was 21 mg/l, which is extremely high. The next downstream station (at Moorhead) had an average of 2.2 mg/l for 31 values for total nitrogen and a high of 8.8 mg/l. Total phosphates highest average was at the Moorhead station (0.52 mg/l).

TONGUE RIVER AND ITS TRIBUTARIES

Nine stations, seven of which are on the main stem of the Tongue River, were examined for this report. (Data from five stations is reproduced in Table 18).

Turbidity

The average turbidity ranged from four JTU's near Dayton to 181 JTU's at Miles City, the largest increase of 151 JTU's comes from below Brandenbert to the Tongue at Miles City.

Suspended Solids

Suspended solids increased from 43 mg/l to 126 mg/l between the Tongue below Brandenberg bridge and the Tongue at Miles City.

Sulfate

Sulfates had the biggest jump from 72 mg/l to 179 mg/l between the Tongue at Monarch and the Tongue at the State line.

Total Dissolved Solids

The largest increase of TDS (273 mg/l to 469 mg/l) occurred between the Tongue at Monarch and the Tongue at the State line.

Nutrients

Nutrients had their biggest increase between the Tongue below Brandenberg and the Tongue at Miles City.

Fecal Coliform

Goose Creek below Sheridan took the honors for fecal coliform with an average of 29,850 col/ml. This may be attributed to the Sheridan sewage treatment plant.

Metals

Total iron and total manganese had averages higher than the standards at several stations with iron having an average value of 19,419 ug/l on the Tongue at Miles City.

Fecal Coliform

Fecal coliform was over its criteria of 200 col/100 ml. at most stations (but not by much) with the station on the Powder River at Arvada having the highest average (660).

Metals

Of the metals which violated the criteria, total iron, total manganese and total zinc had averages above their criteria at all Powder River stations at which they were analyzed. The highest average of total iron and total zinc, with more than one value was at Moorhead (83,800 ug/l and 422 ug/l respectively). The station near Locate had the highest manganese average (1000 ug/l). The EPA-funded station, South Fork Powder River near Kaycee, had the highest average violations of metals (iron - 135,958 ug/l, mercury - 0.4 ug/l, copper - 160 ug/l, chromium - 120 ug/l and cadmium - 20 ug/l) of all the tributaries and main stem streams. However, the average flow was 11 cfs; therefore, the total loading may not be significant.

The supportive report on water quality contains information from the results of several hundred water quality samples taken by the U.S. Geological Survey at 38 locations and by the state or the YTAPO at 11 locations. Data on irrigation return flows and on two special sampling runs down the Tongue and Powder Rivers is also included.

The map in Figure 6 shows the locations of the main sampling sites.

Table 15.

PARAMETERS VIOLATING STREAM CRITERIA
ON THE YELLOWSTONE RIVER

Period of Record
Jan. 1974 - Oct. 1976

PARAMETER	CRITERIA	YELLOWSTONE RIVER STATIONS														
		At Huntley			At Mevers			At Forsyth			Nr. Miles City			Nr. Terry		
		Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.
Flow - cfs	N/A	9725	4810	-	16361	9820	-	16478	9970	-	15328	9210	-	17380	10800	-
Turbidity - JTU	>10	39	15	760	66	15	340	70	42	260	77	20	800	111	80	280
Suspended Solids - mg/l	>70	107	38	1480	156	63	534	136	122	455	188	46	2020	711	118	3130
Sulfate - mg/l	>250	81	91	-	154	165	260	153	160	260	166	170	280	179	190	290
TDS - mg/l	>500	256	280	-	375	395	562	374	386	566	397	413	627	419	452	624
Total Nitrogen mg/l	>0.6	0.9	0.8	3.2	0.9	0.8	2.0	0.9	0.8	2.4	0.9	0.8	3.4	1.2	0.7	4.1
Total Phosphate mg/l	>0.05	0.14	0.08	0.69	0.15	0.07	0.54	0.20	0.10	1.1	0.18	0.06	1.6	0.38	0.15	1.5
Fecal coliform col/100ml	>200	2008	1150	19000	-	-	-	-	-	-	185	12	2100	-	-	-
Copper (total) ug/l	>50	41	30	150	30	20	60	47	35	170	40	40	100	30	30	60
Iron (dissolved) ug/l	>300	34	30	-	40	30	-	54	30	440	101	20	1800	22	20	-
Iron (total) ug/l	>1000	4890	3900	12000	5293	4975	11000	7396	6500	19000	5357	7000	11000	12120	13000	22000
Manganese (diss.) ug/l	>50	10	10	-	10	10	-	25	10	300	13	-	130	20	-	260
Manganese (total) ug/l	>50	158	170	350	180	180	330	240	230	540	158	155	290	190	180	370
Zinc (total) ug/l	>90	81	70	190	38	30	-	46	35	120	56	50	100	72	70	120
Mercury (diss.) ug/l	>0.05	0.24	0.20	0.60	.06	.05	0.20	0.54	0.10	3.00	.08	0.10	0.20	0.15	0.15	0.30
Mercury (total) ug/l	>0.05	0.42	0.10	2.00	.07	0.10	0.20	0.18	0.05	0.70	0.28	0.15	1.00	0.32	0.10	1.70

Table 16.

PARAMETERS VIOLATING STREAM CRITERIA
ON TRIBUTARIES TO THE YELLOWSTONE RIVER

Parameter	Criteria	Tributaries to the Yellowstone River near confluence with Yellowstone River														
		Sarpy Creek nr. Hysham			Armells Creek near Forsyth			Rosebud Creek at mouth			Tongue River at Miles City			Powder River near Locate		
		Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.
Flow - cfs	N/A	38	3	-	29	2	-	110	47	-	618	380	-	1240	500	-
Turbidity - JTU	>10	20	11	100	66	20	400	253	72	2500	181	31	1200	758	170	5800
Susp. Solids - mg/l	>70	-	-	-	-	-	-	-	-	-	126	24	390	-	-	-
Sulfate - mg/l	>250	982	920	2500	1651	1800	2500	334	350	530	241	255	440	603	645	970
TDS - mg/l	>500	1855	1860	4280	2832	2970	4210	824	893	1210	567	600	912	1266	1365	1760
Total N - mg/l	>0.6	1.0	0.7	2.9	1.1	0.9	2.2	1.4	0.9	6.2	1.0	0.7	4.2	2.2	1.3	7.7
Total Phosphate-mg/l	>0.05	0.08	0.03	0.46	0.11	0.06	0.51	0.28	0.12	2.3	0.20	0.07	1.0	0.67	0.51	3.1
Fecal Coliform col/100ml	>200	-	-	-	-	-	-	-	-	-	221	24	2800	211	50	1300
Cadmium (tot) ug/l	>10	12	10	20	13	10	20	10	10	20	10	10	20	10	10	-
Copper (tot) ug/l	>50	29	10	90	57	10	300	22	10	60	50	25	170	74	60	200
Iron (diss) ug/l	>300	111	40	410	70	30	510	41	20	-	34	20	-	50	20	-
Iron (tot) ug/l	>1000	2074	560	11000	1851	840	9700	7220	2550	32000	19419	5100	74000	49257	28000	170000
Manganese (diss)ug/l	>50	90	90	130	135	135	210	30	30	-	4	0	-	4	0	-
Manganese(tot) ug/l	>50	757	110	6000	153	175	270	177	100	570	222	90	680	1008	600	3500
Zinc (total) ug/l	>90	48	50	120	20	20	-	28	30	-	112	55	340	251	150	670
Mercury (diss) ug/l	>.05	.05	.05	0.10	.05	.05	0.10	.05	.05	0.10	.02	0	0.20	.08	0.10	0.30
Mercury (tot) ug/l	>.05	.08	0.10	0.30	0.12	0.10	0.60	0.23	0.10	1.20	0.13	0.05	0.80	0.20	0.20	0.30

Dash (-) in "max." column indicates no violation.
Dash (-) in all 3 columns indicates no data.

Table 17

PARAMETERS VIOLATING STREAM CRITERIA
ON THE POWDER RIVER AND ITS TRIBUTARIES

Period of Record
Jan. 1974 - Oct. 1976

Parameter	Criteria	Powder R. nr. Kaycee			Salt Creek nr. Sussex			Crazy Woman nr. Arvada			Powder R. @ Arvada		
		Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.
Flow - cfs.	-	124	93	-	44	27	-	50	28	-	316	170	-
Diss. Oxygen - mg/l	5.0	9	9	-	7.7	8.2	4.2	6.6	6.6	-	7.5	7.4	-
Turbidity - JTU	10.0	196	20	3000	1400	1400	2600	90	90	90	1665	550	8000
Susp. Solids - mg/l	70.0	-	-	-	-	-	-	-	-	-	-	-	-
Chloride - mg/l	250.0	47	48	-	1152	1275	1600	9	9	-	270	270	543
Sulfate - mg/l	250.0	400	415	672	1088	1050	1900	657	650	1500	923	890	1500
Fluoride - mg/l	2.4	0.5	0.5	-	2.6	3.2	4.7	.5	.5	-	.9	.9	-
TDS - mg/l	500	820	872	1306	4277	4450	5540	1106	1145	2360	2006	1910	3270
Tot. Nitrogen - mg/l	0.6	-	-	-	2.7	1.7	6.6	.9	0.9	0.9	21.0	21.0	21.0
Tot. Phosphate - mg/l	0.05	.10	.03	0.86	.11	.03	1.3	.05	.02	.67	.38	.05	5.9
Fecal Coli. Col/100ml	200	287	63	3400	-	-	-	-	-	-	662	90	4000
Tot. Beryllium - ug/l	11	-	-	-	2.5	0	-	10	10	-	20	20	20
Arsenic Total - ug/l	50	-	-	-	6.2	6	-	4	4	-	12	12	-
Cadmium Total - ug/l	10	-	-	-	10	10	-	10	10	-	30	30	30
Chromium Tot. - ug/l	100	-	-	-	125	10	-	-	-	-	300	300	300
Copper Total - ug/l	50	-	-	-	25	25	-	10	10	-	300	300	300
Iron Total - ug/l	1000	-	-	-	9100	8450	14,000	5200	5200	5200	310,000	310,000	310,000
Lead Total - ug/l	100	-	-	-	-	-	-	-	-	-	400	400	400
Manganese Tot. - ug/l	50	-	-	-	20.5	165	360	190	190	190	5000	5000	5000
Zinc Total - ug/l	90	-	-	-	72	75	-	30	30	-	1600	1600	1600
Selenium Tot. - ug/l	10	-	-	-	1	1	-	1	1	-	12	12	12
Mercury Diss. - ug/l	.05	-	-	-	-	-	-	-	-	-	-	-	-
Mercury Tot. - ug/l	.05	-	-	-	-	-	-	-	-	-	.07	.07	.07

Parameter	Criteria	Piney Cr. nr. Ucross			Clear Cr. nr. Arvada			Powder R. @ Moorhead			Little Powder R.		
		Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.
Flow - cfs	-	162	94	-	296	108	-	1207	312	-	8	7	-
Diss. Oxygen - mg/l	5.0	9.4	9.4	-	10	9.7	-	9.4	9.6	4.6	8.4	8.5	-
Turbidity - JTU	10.0	5.2	2.0	33	20	10	100	593	240	4200	152	45	5000
Susp. Solids - mg/l	70.0	-	-	-	58	19	364	1456	378	9500	-	-	-
Chloride - mg/l	250.0	2.4	2.3	-	4	4	-	128	150	320	10	9	-
Sulfate - mg/l	250.0	124	88	290	392	372	830	602	590	1100	1231	1200	2100
Fluoride - mg/l	2.4	.2	.2	-	.3	.4	-	.4	.4	-	.5	0.5	-
TDS - mg/l	500	308	275	586	667	726	997	1243	1345	1670	2077	2070	3440
Tot. Nitrogen - mg/l	0.6	.67	.66	1.3	.83	.73	1.7	2.2	1.1	8.8	1.6	1.0	9.9
Tot. Phosphate - mg/l	0.05	.03	.02	.16	.03	.02	.18	.52	.11	3.9	.06	.06	0.15
Fecal Coli. Col/100ml	200	283	92	2000	138	40	520	-	-	-	267	52	2000
Tot. Beryllium - ug/	11	2.5	0	-	5	5	-	8.8	10	-	1.67	-	-
Arsenic Total - ug/l	50	2.2	0.5	-	1.5	1	-	48	6	350	5.7	2	55
Cadmium Total - ug/l	10	8	10	-	7.5	10	-	13	10	20	10	10	-
Chromium Total - ug/l	100	4.6	-	-	5	5	-	72	10	500	9.2	-	-
Copper Total - ug/l	50	11	10	-	10	10	-	109	30	900	19	10	140
Iron Total - ug/l	1000	306	220	-	1588	480	5200	83,800	15.000	600,000	5386	2500	63,000
Lead Total - ug/l	100	-	-	-	-	-	-	-	-	800	-	-	200
Manganese Tot.-ug/l	50	34	35	60	85	75	170	383	315	1400	252	220	620
Zinc Total - ug/l	90	27	15	-	14	10	-	442	75	2700	55	30	520
Selenium Total - ug/l	10	.12	-	-	1	1	-	2.6	2	-	1.1	1.0	-
Mercury Diss. - ug/l	.05	.27	-	2.2	.39	-	2.4	.78	.15	4.0	.01	-	.1
Mercury Total - ug/l	.05	.12	-	1.0	0.5	-	2.0	.22	.20	1.1	.14	-	0.8

Dash (-) in "Max." column indicates no violation.

Dash (-) in all 3 columns indicates no data.

Table 18.

PARAMETERS VIOLATING STREAM CRITERIA
ON THE TONGUE RIVER AND ITS TRIBUTARIES
(Continued)

Period of Record
Jan 1974 - Oct 1976

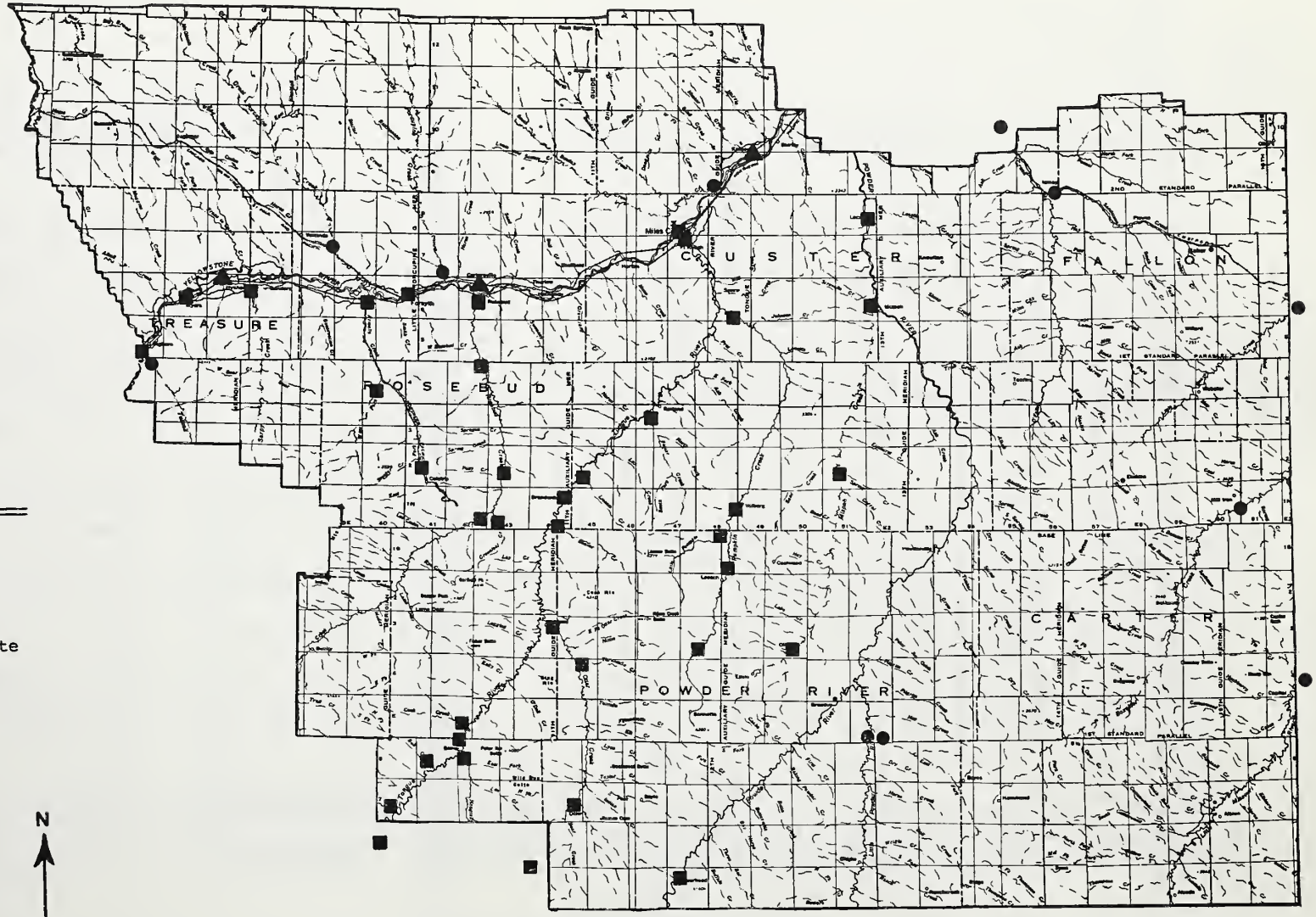
PARAMETER	CRITERIA	At Stateline			TONGUE RIVER AND ITS TRIBUTARY STATIONS: Tongue R below Dam			Bel Hanging Woman Cr			Below Brandenberg Brd.			Pumpkin Cr Nr Miles City		
		Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.	Mean	Median	Max.
Flow - cfs	N/A	639	311	-	252	235	-	602	316	-	669	321	-	3[illegible]	1	-
Turbidity - JTU	10	21	10	100	4.5	3	10	11	6	42	30	8	200	110	12	410
Susp. Solids - mg/l	70	37	18	144	-	-	-	64	10	504	43	33	104	-	-	-
Sulfate - mg/l	250	179	210	300	226	220	26[illegible]	192	205	420	231	260	390	946	1,065	1,700
TDS - mg/l	500	469	536	710	558	554	617	478	509	896	549	618	868	1,746	1,975	3,190
Total N - mg/l	0.6	0.7	0.7	1.7	1.0	0.65	3.8	0.7	0.6	3.3	0.7	0.6	2.0	1.7	1.6	2.8
Total P - mg/l	0.05	.05	.05	0.14	0.03	0.03	.07	0.06	0.04	0.38	0.07	0.03	0.30	0.09	0.03	0.43
Fecal Coliform col/100ml	200	360	80	2,400	-	-	-	-	-		-	-	-	-	-	-
Copper (tot) ug/l	50	10	10	-	7.5	10	-	11	10	-	12	10	-	12	10	-
Iron (tot) ug/l	1,000	1,570	670	4,800	178	170	-	515	320	1,400	1,856	490	13,000	705	435	1,800
Manganese (tot) ug/l	50	110	95	2[illegible]	75	75	90	38	30	80	35	20	70	77	75	120
Zinc (tot) ug/l	90	34	10	11[illegible]	12	15	-	62	40	280	34	30	-	17	15	-
Mercury (Diss) ug/l	0.05	.03	0	0.3	0	0	-	.06	0.10	0.10	0.10	0.10	0.10	0.2	0.2	0.2
Mercury (tot) ug/l	0.05	0	0	0	.02	0	0.1	0.14	0.10	0.60	0.14	0.10	0.50	0.15	0.20	0.2

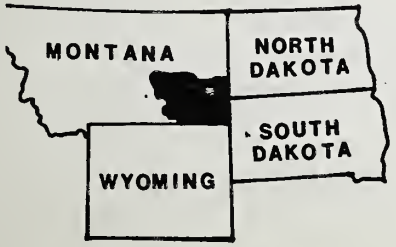
Dash (-) in "Max." column indicates no violation.
Dash (-) in all 3 columns indicates no data.

Figure 6

WATER QUALITY STATIONS

- ■ USGS, monthly
- ● YTAPO/State
- ▲ Irrigation sampling site





scale:
one inch equals sixteen miles

YELLOWSTONE-TONGUE A.P.O.

Funded by an E.P.A.
section 208 grant

VIOLATIONS OF CRITERIA

The data presented in Tables 15 and 18 indicate that the criteria listed in Table 19 have often been exceeded at the stations within the YTAPO area. The average measurement as well as the maximum value measured exceeds the criteria for many of the parameters and sampling sites listed. In a few cases, as with the suspended sediment data from the smaller streams, the lack of a violation actually reflects a gap in the data analyzed by the computer. For example, Pumpkin Creek has a limited number of suspended sediment measurements which reflect very high sediment loadings, but apparently this data was not accessible to the analysis program. This shows the monitoring stations are not intended to identify sources of pollution but form the base for detecting general changes in water quality. This information could be used to direct additional studies to help pinpoint the problem areas.

In spite of the large numbers of criteria violations indicated in the preceeding sheets, the YTAPO does not know of a case in which the data from the sampling sites can be used to document man-induced pollution in a statistically valid method. There are several apparent sources of man-induced pollution, including those documented by the special storm drain and irrigation return flow samples taken by the YTAPO showing elevated levels of man-induced pollutants. However, the data from the federal or state funded sampling sites cannot be used to show the effects of man-induced sediment or other pollutants.

As a result, the YTAPO has concluded that with the exceptions of localized problems, it is not possible to conclusively prove that the waters of the project area are not already in compliance with the 1983 goals of the Clean Water Act Amendments. Although by some standards the Powder River and many of the small tributaries to the Tongue and Yellowstone Rivers do not meet the goal of fishable and swimmable waters, the clause "... wherever attainable," provides adequate relief from the strict interpretation of the goals. It is apparent (but not documentable in a statistically valid fashion) that the guality of the waters, with the above mentioned exceptions, are as good or better than they were prior to the intrusion of the white settlers.

Table 19. Criteria used to evaluate the water quality data.

Parameter	Criteria	Source
DO	5.0 and 7.0 mg/l	State Standard
pH	6.5 and 9.0	S.S.
Turbidity	10	S.S.
Total Suspended Solids	70 mg/l	Coal permit limit
Chloride	250 mg/l	WQC
Sulfate	250 mg/l	WQC
Flouride	1.4 and 2.4 mg/l	Drinking water
Total dissolved solids	500 mg/l	WQC
Total N	0.6 mg/l	Corvallis
NO_3-N	10 mg/l	WQC
Phos-Total	.05 mg/l	Corvallis
Fecal coliform	200 col/100 ml	WQC
Dissolved arsenic	50 ug/l	WQC
Total arsenic	50 ug/l	WQC
Dissolved barium	1000 ug/l	WQC
Dissolved Berylium	11 ug/l	WQC
Total berylium	11 ug/l	WQC
Dissolved boron	750 ug/l	WQC
Total boron	750 ug/l	WQC
Dissolved cadmium	10 ug/l	WQC
Total cadmium	10 ug/l	WQC
Dissolved chromium	50 ug/l	WQC
Total chromium	100 ug/l	WQC
Dissolved copper	50 ug/l	WQC
Total Copper	50 ug/l	WQC
Dissolved iron	300 ug/l	WQC
Total iron	1000 ug/l	WQC
Dissolved lead	50 ug/l	WQC
Total lead	100 ug/l	WQC
Dissolved manganese	50 ug/l	WQC
Dissoved zinc	50 ug/l	WQC
Total zinc	90 ug/l	WQC
Dissolved selenium	10 ug/l	WQC
Total selenium	10 ug/l	WQC
Dissolved silver	50 ug/l	WQC
Dissolved mercury	.05 ug/l	WQC
Total mercury	.05 ug/l	WQC

SURFACE WATER MONITORING

The extreme variability in the quality of rivers and streams in Southeastern Montana makes it difficult to obtain reliable water quality data. Even if a series of four or five samples show relatively uniform results, the sampling conditions should be carefully evaluated. As an example:

1. Were they taken during a period of abnormal precipitation? Runoff from the plains area is very sensitive to rain and snow. The YTAPO was unable to obtain representative spring runoff samples during the two years of the project due to the lack of a "normal" snowfall.

2. Were they from the "first flush" of runoff? It appears that there may be major differences between the salt load in the initial runoff and the middle-of-flow runoff due to a pickup of evaporative salt deposits. The YTAPO was not able to prove or disprove this, but it has been noticed in other areas.

3. Do the samples tend to put an emphasis on extremely low flows? When samples are collected on a monthly basis, 50% to 75% of the samples may represent what is functionally a zero flow condition on all except the major rivers.

4. Does a sample taken on a larger river reflect a storm event centered on one tributary?

5. Does the sample reflect the results of unquantified irrigation diversions or return flows?

The collection of water quality data for a period of one or even two years prior to the establishment of a mine or other development probably does not have much significance. Perhaps a knowledgeable professional could do as well by transposing data from similar basins with a longer record of water quality samples.

It also appears to be important to have more "synoptic" (upstream to downstream) sampling. This type of sampling combined with some basic modeling may give more insight into the reasons for the sample variabilities.

RECOMMENDATIONS

The great expanse of the YTAPO project area combined with the distance from major service centers such as Billings makes it difficult to establish an intensive sampling network at a reasonable cost per sample.

Realizing that funds for sampling are limited, the YTAPO is making the following recommendations for the modification of the existing sampling network:

1. Put a greater emphasis on the correlation of data collected during low flow and high flow "synoptic" sampling sequences with data collected at a limited number of permanent sampling stations. The data collected during "synoptic" sequences can also be used for computer modeling.

2. Attempt to develop better correlations between physical factors (as geology, snowpack, etc.) and the variations in water quality. These correlations might emphasize the range in certain parameters as well as attempting to obtain well fitted regressions.

3. Install continuous recording conductivity units downstream from major developments -- as on the East Fork of Armells Creek below Colstrip--primarily to detect any slugs of ionic contaminants and secondly, to obtain additional data on the variability of the streams.

4. Search the literature to determine if there are any simple techniques using adsorbants which can be utilized to accumulate organic contaminants (as oil and gasoline) and be sent to the laboratory on a periodic basis to determine if any slugs of such compounds have been discharged to the stream.

5. Provide conductivity monitoring equipment to the Soil Conservation Service or the Extension Service to be used for monitoring irrigation water. This would help warn farmers of very high salinity irrigation water.

6. Evaluate the potential for dropping the EPA funded water quality stations at Meyers and Forsyth on the Yellowstone River and below Hanging Woman Creek on the Tongue River.

7. Evaluate the need for the upstream stations on creeks such as Pumpkin and Mizpah. Could they be replaced by annual high and low flow synoptic sampling runs?

8. Initiate common ion and sediment sampling on a monthly basis at the gaging sites on Tullock and Sunday Creeks. If the samples can be picked up by the person taking care of the gage, the added expense would be minimal.

9. Periodically monitor the major irrigation return flows. (This may be a difficult task due to the potential variability in the quantity and quality of the return flows.)

10. The potential conflicts over water use in the Powder River basin may require the attention of a full-time person to monitor the quantity and quality of the water above and below major diversions or reservoirs.

WATER QUALITY PROBLEM AREAS

The primary water quality problem in the YTAPO area is the high contribution of sediment and salts to streams due to natural conditions. Many people would not classify this as pollution.

There are several localized sources of man-induced pollution:

1. Household wastewater resulting from seepage from septic tank systems (or from the lack of septic tank systems) near urban areas. The four major problem areas have been or soon will be corrected -- Ashland, Rosebud, suburban Miles City, suburban Baker.

2. Partially treated human wastewater resulting from malfunctioning municipal wastewater treatment systems. The major problem areas, Forsyth and Ekalaka, are being corrected or brought up to tolerable standards.

3. Saline groundwater resulting from improper irrigation practices is a problem in many irrigated areas along the Yellowstone Valley. It is especially noticeable near Hysham and the east edge of Miles City. Corrective actions, including subsurface drainage, may result in the discharge of moderately saline water to surface drainages.

4. Irrigation return flows will provide a continuous source of moderately saline water and occasionally elevated levels of nutrients. Management practices can moderate but not eliminate these sources.

5. Storm water runoff from urban areas and industrial developments will increase in the future. Currently Miles City and Colstrip are the only areas with developed storm drains. Data from Miles City (included in a supportive report) indicates high fecal coliform levels in the storm water discharges.

6. Runoff from disturbed areas contributing high sediment loads during intense storm events.

Because the YTAPO covers such a large area, the staff felt it could not accurately map every sediment-producing area.

Water quality problems will increase as the area becomes more developed. The types of problems anticipated in the future include those listed below. Due to our inability to predict the exact type and amount of development, it is not possible to provide a quantified prediction of future pollutants.

1. Salinity will increase due to irrigation expansion and to the movement of groundwater through mined areas before reaching the river.

2. The movement of groundwater through mined areas will also cause a change in the ratios between the various ions -- probably an increase in the proportion of magnesium.

3. The selective storage or diversion of the water from the higher quality tributaries of the Powder River in Wyoming would result in a major increase in the salinity of the Powder River in Montana.

4. The construction of additional coal conversion facilities (electrical generation or gasification) would involve disposal of large quantities of residual waste -- primarily sludge of various types -- which could cause long term water quality problems through leaching.

NONDEGRADATION OF WATER QUALITY

The concept of "nondegradation of water quality" has several interpretations, including the complete prohibition of discharge of any contaminants.

The official definition proposed by the State of Montana will allow for the discharge of a limited amount of contaminants. The critical wording is, "... any alteration of the quality of a state water by a new or expanded development shall be prohibited if it will have or is likely to have a measurable adverse effect on any beneficial use established for that water."

Salinity increases related to water withdrawals or to evaporative losses from reservoirs which are developed in the future will be considered to be man-induced and subject to the nondegradation concept.

The nondegradation concept is designed to protect the existing users of surface waters. For example, the salinity of the Powder River is already high by the U.S. Department of Agriculture's standards for irrigation water. The YTAPO has contracted with two groups to estimate the salinity level at which there will be a measurable reduction in the yield of hay crops flood irrigated with river water. The data obtained from the first study indicates the yield of alfalfa would be adversely affected (considering present irrigation practices and soils along the Powder River) by continued use of water with a salinity in excess of 1800 umho. The second study indicated effects starting at 820 to 1900 umho. Both studies assumed fertility, insects, etc., were not limiting factors.

In the case of the Powder River there may be times during low flows when this level may be exceeded naturally. In such cases, the water shall be maintained "as suitable as possible" for the pre-existing beneficial uses of the river. A developer could not cause an increase in the salinity of the already marginally suitable water.

This concept of nondegradation needs to be extended across state lines, as activities in Wyoming could adversely affect the suitability of the water in the Powder River for use in Montana.

This is also a logical area for a tie between water quality and water rights. The holders of early water rights should be protected against adverse changes in water quality caused by those holding more recent water rights.

WATER QUALITY STANDARDS

The State of Montana has established a set of water quality standards and water use classifications. The text of these standards and classifications is included in the supportive report on water quality.

With the exception of a short portion of the Tongue River immediately below the Tongue River Reservoir, all the rivers and streams within the YTPAO project area are classified as B-D_3, which is described below.

B-D_3 Classification

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreational growth, propagation of non-salmonid fishes, and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 5.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 shall be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 77° F; within the naturally occurring range of 77° F to 79.5^{o} F, no thermal discharge is allowed which will cause the water temperature to exceed 80° F; and where the naturally occurring water temperature is 79.5^{o} F or greater, the maximum allowable increase in water temperature is 0.5^{o} F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32°F.

This applies to all waters in the state classified B-D_3, except from the Billings water supply intake to the water diversion at Intake, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 79° F; within the range of 79° F to 81.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 82° F; and where the naturally occurring water temperature is 81.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

From the water diversion at Intake to the North Dakota state line, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 82° F; within the range of 82° F to 84.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 85° F; and where the naturally occurring water temperature is 84.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

(af) No increases above naturally occurring concentration of sediment, settleable solids or residues, which adversely affect the use indicated are allowed.

(ag) Concentration of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions. Also, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

RECOMMENDATIONS FOR MODIFICATION

The current classification system does not contain quantative criteria for salinity (total dissolved solids or TDS). An upper limit of 500 mg/l TDS (approximately 750 umho salinity) is inferred by reference to the Public Health Service Standards for drinking water contained in another part of the regulations. As it seems to be the opinion of personnel from several agencies that the Water Quality Bureau would have difficulty enforcing a salinity standard referenced in this manner, the YTAPO recommends that the Water Quality Bureau establish quantative criteria for salinity.

The YTAPO suggests that the salinity hazard levels presented by the U.S. Department of Agriculture in USDA Handbook 60 be utilized as a basis for establishing the salinity limitations until better information is available.

The Tongue River and other streams currently classified as $B\text{-}D_2$ or $B\text{-}D_3$ should be related to the break point between the USDA medium and high salinity hazard categories -- not to exceed 750 umho. The Powder and similar rivers should be related to the break point between the USDA high and very high salinity hazard categories -- not to exceed 2250 umho. Data collected by a consultant on contract to the YTAPO indicates specifically for the Powder River that the average conductivity of the Powder should not exceed 1800 umho in order to protect existing users of the river.

The use of the above "not to exceed" levels would appear to be realistic as the average of 203 pre-1976 measurements made by the USGS on the Tongue River at the Montana/Wyoming state line indicated a conductivity of 706 umho. Also, the average of 82 pre-1976 measurements made by the USGS on the Powder River at Moorhead indicate a conductivity of 1883 umho. The average salinity of both of these rivers as they enter the state is within the proposed limits.

In addition, if the average ratio between dissolved solids and conductivity for the Tongue River is utilized, the limit of 750 umho converts almost exactly to the 500 mg/l limit being proposed for dissolved solids as part of the "National Secondary Standards for Drinking Water".

The Yellowstone-Tongue APO also recommends that two new classifications be established (probably $C\text{-}D_3$ and $C\text{-}D_4$) to reflect the actual water quality in the Powder River and its tributaries. The details of our proposed classification are attached. Essentially, they are similar to a $B\text{-}D_3$ classification, but recognize that some rivers carry a high dissolved solids load which renders the water undesirable for domestic and irrigation water supplies.

1. A quantative salinity (TDS) criteria, similar to the following should be attached to the B-D_2 and B-D_3 classifications. The Water Quality Bureau might also consider attaching salinity standards to the higher classifications which are not applicable to the YTAPO project area.

   The total man-induced dissolved solids load shall not cause a rise of over 100 umho above natural and shall not cause the salinity to exceed 750 umho. Salinity levels are to be given as umho/cm at 25° C.

   OR - The total man-induced dissolved solids and/or sodium load shall not cause a rise of over 10% above natural and shall not cause the water to enter the high or very high salinity or sodium hazard categories for irrigation use as defined in the USDA Handbook 60. Salinity increases related to partial stream dewatering or evaporative losses from reservoirs constructed after July, 1971, shall be considered to be man-induced.

2. A C-D_3 or similar classification should be established which recognizes the high dissolved solids loads carried by many of the streams in Southeastern Montana.

PROPOSED C-D_3 CLASSIFICATION

(i) Water-use description. The quality is to be maintained as suitable for the growth of non-salmonoid fisheries and associated aquatic life and for the growth and propagation of waterfowl and furbearers. As the quality of these waters is naturally marginal for recreational, drinking, food processing, agricultural, and industrial use, such existing quality shall not be degraded. The waters will be maintained in a condition suitable for the above uses when no better source of water is available.

OR - Water-use description. The quality is to be maintained as suitable for the growth and propagation of non-salmonoid fisheries and associated aquatic life and for the growth and propagation of waterfowl and furbearers. As the quality of these waters is naturally marginal for drinking, food processing, and irrigation use, such existing quality shall not be degraded. These waters will be maintained in a condition suitable for the above uses and for other agricultural, industrial, and recreational uses when no better source of water is available.

(ii) Specific water quality criteria.

   (aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters.

   (ab) Dissolved oxygen concentration is not to be reduced below 5.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH above 7.0 shall be maintained above 7.0.

The maximum allowable increase in turbidity or suspended sediment should not exceed 20% of the naturally occurring level when measured as nephelometric turbidity units or as mg/l suspended matter, respectively.

A 3° F maximum increase above naturally occurring water temperature is allowed if the resulting temperature does not exceed 80° F. If the natural water temperature is 79° F or greater, the maximum allowable increase shall be 1° F. No change in temperature shall exceed a rate of 2° F per hour.

The total man-induced dissolved solids load shall not cause a rise of over 200 umho above natural and shall not cause the salinity to exceed 2250 umho. Salinity levels are to be given as umho/cm at 25° C. Salinity changes related to partial stream dewatering and evaporative losses from reservoirs constructed after July, 1971, shall be considered to be man-induced.

OR - The total man-induced dissolved solids or sodium load shall not cause a rise of over 10% above natural and shall not cause the water to enter the very high salinity or sodium hazard categories for irrigation use as defined by the USDA Handbook 60. Salinity increases related to water withdrawals or evaporative losses from reservoirs constructed after July, 1971, shall be considered to be man-induced.

(ad) No increases above naturally occurring concentrations of sediment, settleable solids or residues which adversely affect the use indicated are allowed.

(ae) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U.S. Public Health Service Drinking Water Standards or subsequent editions. Also, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(af) True color is not to be increased more than five units above naturally occurring color.

3. A C-D_4 or similar classification should be established which recognizes the high dissolved solids loadings and the intermittant nature of may streams in Southeastern Montana.

PROPOSED C-D_4 CLASSIFICATION

(i) Water Use Description: While these streams may not support resident fisheries, they are tributaries to reservoirs or higher quality streams that do support fisheries and provide water for agricultural uses. Therefore, the quality shall be maintained as suitable for the growth of non-salmonoid fisheries and associated aquatic organisms, for the propagation and growth of waterfowl and furbearers, and for agricultural and industrial uses other than food processing.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters.

(ab) Dissolved oxygen concentration is not to be reduced below 5.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 shall be maintained above 7.0.

The maximum allowable increase in turbidity or suspended sediment should not exceed 20% of the naturally occurring level when measured as nephelometric turbidity units or as mg/l suspended matter, respectively.

A 3° F maximum increase above naturally occurring water temperature is allowed if the resulting temperature does not exceed 80° F. If the natural water temperature is 79° or greater, the maximum allowable increase shall be 1° F. No change in temperature shall exceed a rate of 2° F per hour.

The total man-induced dissolved solids load shall not cause a rise of over 200 umho above natural and shall not cause the salinity to exceed 2250 umho. Salinity levels are to be given as umho/cm at 25° C. Salinity changes related to partial stream dewatering and evaporative losses from reservoirs constructed after July, 1971, shall be considered to be man-induced.

OR - The total man-induced dissolved solids or sodium load shall not cause a rise of over 10% above natural and shall not cause the water to enter the very high salinity or sodium hazard categories for irrigation use as defined by the USDA Handbook 60. Salinity increases related to water withdrawals or evaporative losses from reservoirs constructed after July, 1971, shall be considered to be man-induced.

(ad) No increases above naturally occurring concentration of sediment, settleable solids or residues which adversely affect the use indicated are allowed.

(ae) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U.S. Public Health Service Drinking Water Standards or subsequent editions. Also, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(af) True color is not to be increased more than five units above naturally occuring color.

4. If the above classifications are established, then the streams in Southeastern Montana be classified as follows:

Yellowstone River drainage below the Big Horn River except for the following . . . . . $C\text{-}D_4$

Yellowstone River mainstem . . . . . $B\text{-}D_3$

Sarpy Creek . . . . . $C\text{-}D_3$

Armells Creek . . . . . $C\text{-}D_3$

E. Fk. Armells Cr. below Colstrip . . . . . $C\text{-}D_3$

Rosebud Creek . . . . . $C\text{-}D_3$

Great Porcupine Creek . . . . . $C\text{-}D_3$

Little Porcupine Creek . . . . . $C\text{-}D_3$

Tongue River (mainstem) from Tongue River reservoir to, but excluding Prairie Dog Coulee . . . . . $B\text{-}D_2$

Remainder of Tongue River mainstem . . . . . $B\text{-}D_3$

Hanging Woman Creek . . . . . $C\text{-}D_3$

Otter Creek . . . . . $C\text{-}D_3$

Sunday Creek . . . . . $C\text{-}D_3$

Powder River mainstem . . . . . $C\text{-}D_3$

Mizpah Creek . . . . . $C\text{-}D_3$

Lt. Powder below E. Fork Little Powder . . $C\text{-}D_3$

O'Fallon Creek below Sandstone Creek . . . $C\text{-}D_3$

The Little Missouri River and Belle Fourche River drainages except as follows. . . . . $C\text{-}D_4$

Little Missouri River mainstem . . . . . $C\text{-}D_3$

Little Beaver Creek . . . . . $C\text{-}D_3$

Box Elder Creek . . . . . $C\text{-}D_3$

WASTE LOAD ALLOCATIONS

Waste load allocations are normally made to determine how much decomposable material cities or industries can discharge to an already polluted river without causing the oxygen level of the water to drop below a critical level. A river which will not meet standards, even after incorporating Best Practicable Treatment and secondary treatment, is considered to be WATER QUALITY LIMITED. Exceeding the standards is usually associated with the number of discharges or with nonpoint sources.

If a river is presently meeting or capable of meeting water quality standards upon implementing secondary treatment for municipalities and Best Practicable Treatment for industries, the river is considered to be EFFLUENT LIMITED.

Relative to the conventional standards, all the streams and rivers within the YTAPO project area are effluent limited. Waste load allocations for decomposable materials (carboniferous or nitrogenous oxygen demand) will not have to be done.

Short segments of two streams, East Fork of Armells Creek below Colstrip and Russell Creek below Ekalaka, should be monitored to prevent adverse effects of relatively high BOD loadings. Colstrip and Ekalaka are the only communities discharging (or soon to discharge) wastewater from an aerated treatment system to a stream without any major dilution by the receiving waters. Whenever a representative of the Water Quality Bureau inspects these plants, he/she should inspect the creek downstream to determine if there is any evidence of sludge accumulations, anaerobic conditions, or other adverse impacts upon the stream.

The other aerated sewage treatment systems, Forsyth and Miles City, discharge to the Yellowstone River which has adequate flow to dilute the effluent from these relatively small communities to the point where it has no noticeable impact upon the river.

With the elimination of most of the industrial discharge permits in the oil fields, (only Union Texas and Peabody hold discharge permits allowing discharges under other than emergency conditions) there are no industrial point sources requiring the development of waste load allocations.

NONPOINT SOURCES VS WASTE LOAD ALLOCATIONS

Waste load allocations have historically been done for point source discharges. Each discharge could be easily measured and limited.

A waste load allocation may have to be done for nonpoint source salinity loads on the Powder and perhaps on the Tongue River within the YTAPO project area. Relative to the proposed quantative salinity standards, these rivers are WATER QUALITY LIMITED, as are most of the

minor tributaries to these rivers and to the Yellowstone River. As a result, theoretically, the allowable discharge of dissolved solids should be proportioned out among those discharging salts to the rivers. In addition, management practices should be modified to meet a lower level of total salt discharge. Realistically, existing nonpoint sources of salts are considered to be natural sources. Future developments which tend to increase the salt load of the river will be restricted to a certain level of salt loading.

Essentially, this is an attempt to implement the nondegradation concept on a basis which allows a limited number of new developments to share the amount of increased salt loading which can be tolerated. This additional salt loading may be zero under "average" flow conditions.

CLASSIFICATION OF STREAMS

The guidelines for the completion of "208" projects require that the YTAPO classify the streams and rivers within the project area as water quality limited or effluent limited. Normally, these designations would be done on a map. Due to the lack of complexity of this classification for the YTAPO area, the map has been omitted.

Relative to nonpoint source total dissolved solids loadings, all streams are considered to be water quality limited, including the Yellowstone River below the Bighorn River.

Tables 20 to 22, taken from the Department of Natural Resources and Conservation Draft EIS for Water Reservation Applications, illustrate that the Lower Yellowstone and Tongue Rivers exceed the proposed 750 umho (approximately 500 mg/l TDS) criteria eight out of twelve months under median (50%) flow conditions. The Powder River exceeds the proposed 2250 umho (approximately 1500 mg/l TDS) salinity criteria three out of twelve months during median (50%) flow conditions. The tables also illustrate that the Tongue and Powder Rivers are very susceptible to additional development which would cause major increases in salinity of the remaining water.

While the tables were based on increased irrigation development, most types of industrial development utilizing water from the rivers would have a similar effect.

A simplified illustration of how the diversion of high quality tributary water for industrial use could have a major adverse impact on the Powder River in Montana is provided in Figure 7. The impact is two-fold -- a degradation in the quality of the water supply and a decrease in the volume of dilution water.

Table 20. Outflows and total dissolved solids for the Lower Yellowstone Basin (below the Powder River) showing the median and low flows measured in the past (historical) and the impact of a high level of additional irrigation development (simulated).

	50% (MEDIAN)				90% (LOW FLOW)			
	Historical		Simulated		Historical		Simulated	
Month	Flow	TDS	Flow	TDS	Flow	TDS	Flow	TDS
Jan	327,344	648	308,226	670	200,095	750	196,365	772
Feb	340,096	591	326,122	604	256,410	632	245,761	647
Mar	635,385	510	593,263	528	343,573	615	292,420	657
Apr	547,605	560	511,933	572	345,280	604	358,737	617
May	1,196,647	357	971,412	405	569,424	459	400,958	533
Jun	2,321,298	281	2,132,337	284	1,217,402	242	1,064,324	261
Jul	1,244,332	298	974,208	343	532,541	335	309,444	458
Aug	446,355	452	264,510	593	237,778	542	61,528	880
Sep	431,778	537	279,310	633	218,388	622	111,365	789
Oct	489,571	549	450,539	596	338,778	639	307,736	699
Nov	441,416	578	424,565	601	340,461	644	338,862	660
Dec	360,109	631	348,206	645	243,249	671	230,268	692
Annual	8,724,936	419	7,584,631	452	4,843,379	481	3,973,088	538

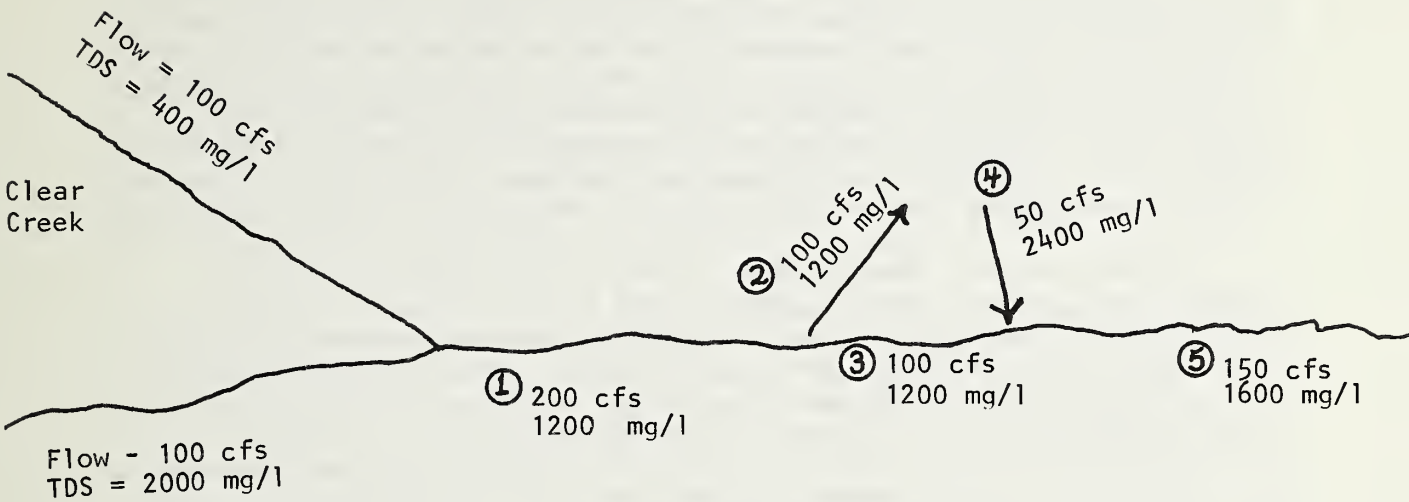
Table 21. Outflows and total dissolved solids for the Powder River Basin showing the median and the low flows measured in the past (historical) and the impact of a low level of additional irrigation development (simulated).

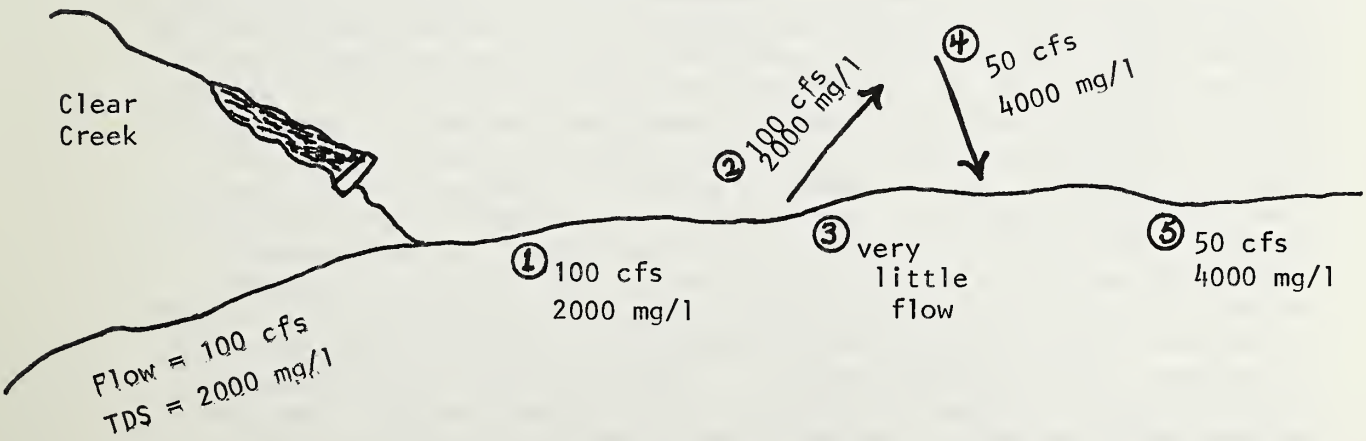
	50% MEDIAN FLOW				90% LOW FLOW			
	Historical		Simulated		Historical		Simulated	
Month	Discharge	TDS mg/l	Discharge	TDS mg/l	Discharge	TDS mg/l	Discharge	TDS mg/l
Jan	6,393	1,754	750	3,121	1,967	1,931	750	3,511
Feb	11,160	1,279	3,312	1,320	3,565	1,608	500	3,511
Mar	53,543	989	34,922	1,163	17,889	1,238	750	3,472
Apr	34,266	1,340	30,600	1,192	20,643	1,445	2,315	2,059
May	63,747	990	51,484	1,189	26,065	1,149	14,066	1,704
Jun	100,360	986	91,303	1,204	10,946	1,237	3,500	3,439
Jul	27,601	1,238	4,500	3,041	2,889	1,931	4,500	3,511
Aug	9,221	1,637	4,500	3,292	861	1,771	4,500	3,511
Sep	4,164	1,363	2,500	3,292	535	1,544	2,500	3,511
Oct	7,192	1,468	2,000	3,267	553	2,049	2,000	3,511
Nov	10,351	1,475	1,250	3,267	3,688	2,017	1,250	3,511
Dec	7,069	1,929	1,000	3,267	3,750	2,196	1,000	3,511
Annual	335,067	1,137	228,121	1,339	93,331	1,390	37,631	2,739

Table 22. Outflows and total dissolved solids for the Tongue River Basin showing the median and low flows measured in the past (historical) and the impact of a low level of additional irrigation development (simulated).

	50TH-PERCENTILE FLOW				90TH-PERCENTILE LOW FLOW			
	Historical		Simulated		Historical		Simulated	
Month	Discharge (af)	TDS mg/l	Discharge (af)	TDS mg/l	Discharge (af)	TDS mg/l	Discharge (af)	TDS mg/l
Jan	10,266	700	10,809	716	8,114	740	1,120	1,110
Feb	11,882	596	12,878	597	6,385	670	5,296	723
Mar	28,278	480	30,142	482	13,524	548	15,005	557
Apr	24,569	570	24,819	583	8,923	665	13,198	657
May	43,154	459	48,560	465	12,479	563	21,019	567
Jun	82,096	291	104,813	283	13,564	440	9,861	604
Jul	25,204	368	14,939	506	3,135	604	2,215	1,357
Aug	7,746	509	2,215	1,212	1,107	765	2,215	1,373
Sep	11,541	501	1,630	1,108	1,190	800	1,630	1,229
Oct	14,569	540	1,485	1,152	2,152	762	1,485	1,274
Nov	17,490	590	9,496	720	5,533	760	1,265	1,364
Dec	12,356	703	11,172	799	6,332	820	1,190	1,360
Annual	289,151	454	272,958	460	82,438	623	75,499	705

Figure 7. A simplified illustration of how the diversion of high quality tributary water for industrial use could have a major adverse impact on the Powder River in Montana.





① Water in the Powder River at the Wyoming/Montana border.

② Diversion of water for irrigation.

③ Water remaining in the river.

④ Irrigation return flow - assumption of 50% evaporative loss.

⑤ Water remaining in the river for downstream users.

Several models have been developed by state and federal agencies and be private corporations. The Water Quality Bureau has used a number of these in an effort to evaluate the impact of additional withdrawals from the Yellowstone River. Also, the Department of Natural Resources and Conservation used a model developed in-house to assess impacts of water reservations on the same drainage. The YTAPO has worked with the Tetra Tech model developed for use on stream systems in the Northern Great Plains. This model has a great deal of potential for describing hypothetical flow situations in Southeastern Montana. The initial calibration work was accomplished using available data for the Tongue River.

The model has the capability to incorporate chemical reactions along stream reaches, such as DO sags, BOD levels, and COD levels. Also, it is an accounting system for dissolved solids showing, by tabular output and graphically, the concentration in the stream and up to two sub-levels of tributary mainstems of n parameters. The model can show concentrations of particular parameters at a certain location of the stream on an hourly basis or those concentrations at a certain time for a number of locations along the stream. If enough data is available, water temperatures, water lost to evaporation, and sediment transport can also be plotted.

Herein lies the difficulty of working in this or any stream water quality model. The degree of model sophistication depends solely on the types and quantities of data available on that stream.

In order to have an accurate representation of dissolved constituents along a stream it is necessary to know where water enters and leaves the system, and at what relative times. This data is not extremely hard to acquire but may not be readily available because of past sampling practices. A higher level of modeling involving temperatures, evaporation rates, and reaction rates requires knowledge of climatic conditions. Weather information must be known or assumed including relative humidities, nightly and daily air temperature, and rainfall characteristics. Geology also plays an important role in the types of stream bottoms, slopes, and the degree of natural aeration. Since water temperatures depend on sunlight absorption rates, the depth and velocity of the water as well as cloud cover percentages and the sun's angle should be known or assumed. The characteristics of sediment transport should also be known. Scouring and settling velocities for three particle sizes can be handled by the model. Seldom is this information available for even a mean sediment type found in a particular drainage.

The model requires stream cross-sections and correlations to discharge rates. These data are often available but not necessarily representative of the natural stream conditions. Measurements are usually taken at bridge crossings or sections offering ease and accuracy of measurements, while the natural stream bottom during low flows is represented by numerous braided channel.

In general, by the time the correct data is obtained, the river itself is well known. The model, however, provides a complete outline of the types of information needed to understand a stream system and allows manipulation of hypothetical situations.

In complex systems where numerous inflows and withdrawals are interacting with natural surface and groundwater recharges to the system, the model allows an investigator to look at a number of situations and determine the most advantageous. It must be restated that the model output is only as good as the input data. Assumptions are often made and these must be considered when looking at the output results. When using the model a qualitative feel for its accuracy also depends on how well the operator knows a particular drainage. Therefore, that person should have intimate field knowledge of the modeled stream.

Initial verification of the Tetra Tech model has been completed utilizing data obtained on the Tongue River. There have been some delays in applying the model to the Powder River. The river cross-sections taken from gaging sites do not appear to be representative of the river in general and it has not been possible to quantify the diversions and returns related to irrigation.

GROUNDWATER

The results of the public meetings held by the YTAPO indicated that the preservation of useable groundwater was to be given a very high priority. This is somewhat contrary to the typical "208" project. Most programs similar to the YTAPO have been putting a major emphasis on surface water and have done very little work with groundwater.

The Board of Directors of the YTAPO anticipated some of the interest in groundwater and asked the YTAPO staff to work on selected groundwater projects at the start of the program.

It is very difficult to develop undisputable evidence concerning the contamination of a groundwater system. For example, the YTAPO has been working with a subsurface gasoline spill and has not been able to "prove" the source of the spill, even though there was two feet of gasoline in a monitoring well within eighteen feet of the suspected leaky tank.

To show positively that contamination has resulted from exploratory drilling, seismic activity, etc. is even more difficult. As a result, the YTAPO has taken the attitude that the need to protect the groundwater is great enough to require all reasonable precautions be implemented.

QUALITY OF THE GROUNDWATER

The quality of the groundwater within the YTAPO area is quite variable. A summary of groundwater quality data is provided in Table 23. In general, the shallow (up to two or three hundred feet deep) groundwater is quite variable in quality and often tends to be moderately hard or high in iron. The moderately deep groundwater (several hundred feet) tends to be high in sodium and very soft. The very deep groundwater (several thousand feet) tends to be high in calcium and rather hard.

Table 23 SELECTED WATER QUALITY SAMPLES

	Depth feet	SAR	TOTAL DISSOLVED SOLIDS ppm	HARDNESS ppm	IRON ppm	FLOURIDE ppm	SULFATE ppm
Shallow, river bottom wells	25	3.1	934	470	6.0	.4	302
	18	5.8	1,710	646	-	.8	825
Fort Union Formation Wells	192	3.3	1,360	745	25.4	.5	413
	210	40	635	9	0	2.2	1.5
	140	21	4,090	610	.2	.4	2200
Hell Creek Formation Wells	850	20	762	44	.1	1.4	107
	371	65	780	5	0	2.2	16
Tongue River at Miles City		1.4	555	325	.05	.4	225

The results of several hundred groundwater quality sample analyses are contained in a supportive report prepared for the YTAPO by the Montana Bureau of Mines and Geology.

TYPES OF GROUNDWATER PROBLEMS ANTICIPATED

Groundwater contamination problems normally fall into two categories -- contamination due to the interconnection of a high quality aquifer with a low quality aquifer, and contamination introduced by man. A third type of contamination is expected within the YTAPO area -- contamination due to man-induced leaching of soluble materials. This category includes the result of shallow groundwater moving through areas disturbed by mining, and the effects of saline seep and irrigation in areas where the soils have a high natural salinity.

INTERCONNECTION OF AQUIFERS

The interconnection of aquifers usually occurs when wells or exploratory drill holes are not properly sealed or plugged. This allows mixing to occur between the aquifers and, in the case of confined aquifers, may cause a loss of pressure. Often the quality of the water in two neighboring aquifers is quite similar and it is difficult to detect any changes due to the mixing of naturally occurring groundwater.

There are two special cases of interconnection which may cause problems. In some areas near the coal fields there are zones of relatively low quality water above zones of better water. Improperly sealed or plugged holes would allow the poorer quality water to move down into the better water. The second type of potential problem involves the leakage of man-induced contaminants from a relatively isolated zone into a useable aquifer via old drill holes or wells or through geologic discontinuities.

The secondary and tertiary recovery of petroleum and solution mining for uranium present the potential for this type of problem. Normally the fluids being injected during the mineral recovery operation are confined to the geologic zone containing the petroleum or uranium. But if corroded well casings, unplugged drill holes, or geologic discontinuities are present, a portion of the fluids may escape and contaminate an aquifer useable for domestic purposes.

CONTAMINANTS INTRODUCED BY MAN

The intentional injection of wastes into the ground is used as a means of disposal of partially treated wastes from a packing plant in Miles City, and for the disposal of saline water in most of the oil fields.

The use of cesspools, septic tank adsorption fields, etc., for the disposal of partially treated human wastes could also be considered to be a type of shallow underground injection.

New state and Federal rules are being proposed to control the disposal of wastes by injection into the subsurface materials. The text of these laws will be incorporated into the supportive report on groundwater when the details of the laws are finalized.

CONTAMINATION DUE TO LEACHING

This type of groundwater contamination may affect large areas of the YTAPO project in the future. In most cases the results will not be directly harmful to man but may reduce the productivity of the water and soil.

Samples taken from beneath several feedlots have indicated high nitrate levels due to the transport of nitrogen from animal wastes downward with the water. If shallow wells were located adjacent to these feedlots this well water could be toxic to young children. More information is included in the Agricultural Report available from the YTAPO.

The application of irrigation water to lands above the river bottom may result in the leaching of salts from the soil and their transport to seepage areas. This could result in a problem very similar to the saline seep problems in some areas of dryland farming. Saline seep is caused by an excess of natural precipitation moving down through the ground when the land lays fallow every other year. Often there is a layer of clay or other tight material a short distance below the surface of the ground and the water moves along this layer and eventually seeps out onto the surface of the ground causing a saline area.

Classic saline seep is not extensive within the YTAPO area but appears to be increasing, especially in Fallon County.

Mining coal in areas between the place where the shallow groundwater system is recharged by the infiltration of surface water and the place where the groundwater system discharges to a river or stream may cause a special kind of "saline seep". If the mine intercepts the aquifer and broken up shale, etc. and is placed back into the area through which the groundwater will move in the future, the water moving through this returned material will leach out soluble salts, etc. at a much higher rate than the materials were leached out of the original geologic formation. Some of these salts will be transported with the water to the river or stream down slope from the mined site. Also, people with wells adjacent to or downslope from the mined site which penetrate this shallow aquifer will have an increased level of dissolved solids.

The selective placement of mine spoils may moderate this problem, but the techniques have not been proven.

NONDEGRADATION OF GROUNDWATER

The YTAPO supports a rather strict nondegradation concept relative to groundwater. As with surface water, it is not practical to require that absolutely no contamination of the groundwater system take place. The enforcement of a zero contamination requirement would eliminate many types of agricultural operations and would make it impossible to mine most of the coal within the project area.

As a result, the nondegradation of groundwater concept must be similar to the surface water nondegradation concept in that a limited amount of contamination is allowed, if it can be proven that there are no adverse impacts on the existing uses of the groundwater. Even with this qualification, some of the existing and proposed agricultural and mining operations could be considered illegal. An additional clause, one allowing for contamination in the case of overriding social and economic need, is often utilized to provide a legal escape for those operations which have a high potential for causing some contamination of the groundwater.

For the purposes of groundwater nondegradation, increases in dissolved solids or increases in selected components of the total dissolved solids load that are related to mining, agricultural practices, mineral recovery practices, etc., shall be considered to be man-induced contaminants. The impact of this contaminated groundwater upon surface waters shall also be considered to be man-induced and subject to any nondegradation concept or waste load allocation being applied to such surface waters.

The YTAPO realizes that the impact of modified groundwater upon surface waters will be difficult to quantify except for extreme cases. In addition, the main impact may occur some years after the disturbance has occurred. However, in order to maintain the standards being proposed for the rivers and streams within the project area, the potential long-term slow increase in dissolved solids resulting from mining and other disturbances must be moderated.

All groundwater experts consulted by the YTAPO staff have agreed that mining and the resultant replacement of spoils into a previously stable area will degrade the groundwater. But nobody has been able to provide accurate estimates of the amount of degradation. Research in progress may provide the techniques needed to estimate the impact of mining on the groundwater system. Until techniques are developed which are accepted by both industry and environmentalists, the impact of mining on groundwater will be an area of much debate.

Processes other than coal mining may impact the quality of the groundwater. Improperly plugged exploratory holes and abandoned wells (oil field, domestic, etc.) can allow the interconnection of aquifers. Inadequate household wastewater disposal systems and leaky chemical storage tanks can contaminate shallow aquifers.

PROPOSED REGULATIONS AFFECTING GROUNDWATER

Recent awareness of the need to maintain the groundwater for future use has resulted in proposals for several types of regulations.

The YTAPO has proposed regulations to cover two specific problems occurring or potentially occurring within Southeastern Montana -- improper plugging of exploratory drill holes and unregulated use of solution mining for uranium in one of the area's primary aquifers. Information on these proposals is contained in the chapter on Implementation and in the supportive reports.

The State of Montana has developed a draft copy of regulations concerning groundwater pollution. When finalized, these regulations would be patterned after the MPDES requiring permits for discharging to groundwater and prohibiting discharges in cases where degradation of groundwater would occur. Injection of brines and makeup water for secondary recovery of oil would be treated on a case-by-case basis but would not necessarily require individual permits for each injection well. The tertiary recovery of oil should also be included in the permit process. The tertiary project at Belle Creek, though funded by the Energy Research and Development Administration, should be required to obtain a permit discharge.

The groundwater regulations include the procedures for permit application. They would require the Water Quality Bureau to examine all surface water discharges covered by the MPDES to determine whether groundwater would be impacted by these same point sources. If so, the discharger would be required to apply for a permit within six months of the first annual state inspection.

It is assumed that many surface discharges would have little or no impact on groundwater and would not need a groundwater discharge permit. If a discharge to groundwater is not covered by an MPDES permit, e.g. seepage lagoons, drainage wells, wastewater injection wells, etc., the discharger would have one year from the effective date of the regulations to apply for a permit. The regulations would cover any point source discharge to the groundwater system including sewage treatment plant effluent, mine tailings, smelter operations, wastewater injection wells, and ponds or wells collecting wastewater and allowing seepage.

The U.S. Environmental Protection Agency has proposed a set of regulations relating to injection of wastewater. Their Underground Injection Control regulations will set up the federal discharge permit system covering injection and drainage wells. Both state and federal regulations are in a draft stage but should be finalized by July 1, 1978.

PROBLEMS AND CORRECTIVE MEASURES

The "208" programs have been envisioned by most people as a means to correct existing problems and clean up the nation's waters so that fishing, swimming, and other uses would not be impeded. The YTAPO has taken a different stance. It will emphasize preventive practices rather than corrective practices.

By conventional standards, the quality of the water in the Powder River and many of the tributaries to the Tongue and Yellowstone Rivers is not good. However, this water is being used and is sensitive to future degradation.

Much of the contaminant loading results from natural sources. Some geologic formations are high in salts that eventually reach the streams. Other areas have high natural rates of erosion. It appears logical that present irrigation practices and farming have increased salinity. But it is very difficult (probably statistically impossible) to isolate man-induced sediment or salinity from natural loading unless one undertakes a very expensive monitoring program. At present, such a program can not be justified.

The low population density of the area has prevented the classic water pollution problems, high bacteria counts and low oxygen levels due to human wastes. A few obvious human wastewater related problems have been detected and are in the process of being corrected. These problems were in or near concentrations of people -- Ashland, Baker, Ekalaka, Forsyth, Miles City, and Rosebud.

The corrective and preventive measures discussed in the following pages will vary from a need for additional public awareness to a need for specific regulations. Some needs will be described in detail.

The goal of the YTAPO has been to develop a water quality management plan which is acceptable to the majority of the residents of the six counties and also fulfills the requirements of the Federal Water Pollution Control Act Amendments. Some people will not like all the recommendations. Also, in a few cases, the recommendations are contrary to the currently accepted interpretation of the Federal Act and may not be accepted by the Governor or the EPA.

Fifteen communities have central wastewater treatment systems. Twelve communities are discharging partly treated wastewater to a streambed or river. Table 24 provides a brief description of these systems.

The early guidelines for "208" programs indicated that a major effort was to be expended on planning "areawide wastewater treatment facilities" -- to integrate several neighboring systems into one system. Less emphasis has been placed on this aspect of the program during the last two years. Due to the rural nature of the YTAPO area, there was only one opportunity to integrate neighboring treatment systems. Ashland and St. Labre developed a joint treatment system without the assistance of the YTAPO. With this exception, each community is responsible for only its own wastewater.

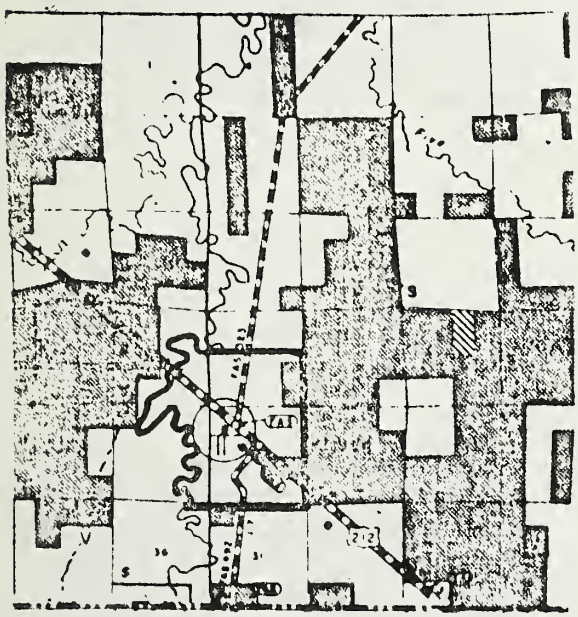
Table 24

SUMMARY OF EXISTING FACILITIES

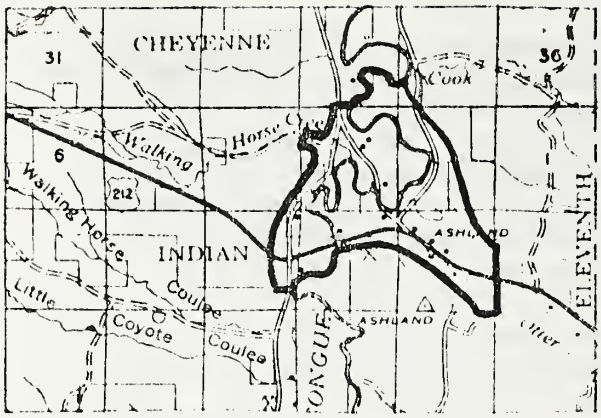
Community	Existing Facility	Size	Discharges	Permit Number
Ashland St. Labre	2-cell lagoon	18 acres	No Dis.	No Permit
Ashland Homes	2-cell lagoon	1.4 acres	Intermit.	No Permit
Baker	3-cell lagoon	30 acres	Cont.	22381
Belle Creek	2-cell lagoon	0.75 acres	Intermit.	22501
Birney Village	Septic Tanks	-	-	No Permit
Broadus	2-cell lagoon	6.75 acres	Intermit.	22110
Busby	2-cell lagoon	3 acres	Intermit.	No Permit
Colstrip	3-cell lagoon		Intermit.	22373
Ekalaka	Activated Sludge	75,000gpd	Cont.	20371
Forsyth	2-cell lagoon	8.0 acres	Cont.	21288
Hysham	2-cell lagoon	5.0 acres	Cont.	21709
Lame Deer	3-cell lagoon	10 acres	Cont.	23141
Miles City	3-cell lagoon	118 acres	Cont.	23612
Muddy Creek Homes	2-cell lagoon	1 acre	No Dis.	No Permit
Plevna	2-cell lagoon	2.1 acres	Intermit.	21776
Rosebud	Septic Tanks	-	-	No Permit
St. Labre	2-cell lagoon	2.0 acres	No Dis.	22985

MUNICIPAL SERVICE AREAS

Within the Yellowstone-Tongue 208 area there are 17 communities that possess, or can reasonably be expected to have potential for centralized sewage treatment facilities. Of these, five presently have at least a partially centralized system. After preliminary study of population projections and general topographic limitations the following service areas were delineated. The population figures included are from the 1970 Census unless otherwise indicated.

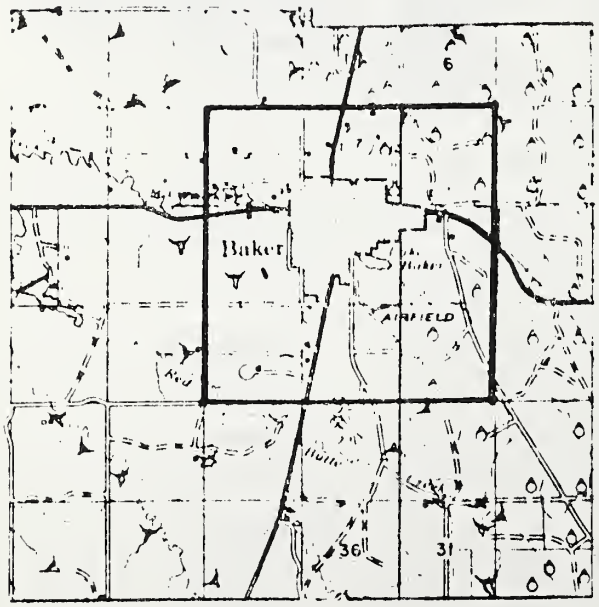


ALZADA, (Pop. 50), is one of three communities with no central system. Originally called Stoneville, Alzada has been a stable ranching service though recent activity in uranium mining has had a limited impact on Alzada due to a lack of readily available space for housing and water and sewer services. If uranium activity increases enough, impetus might be provided to develop space and services.

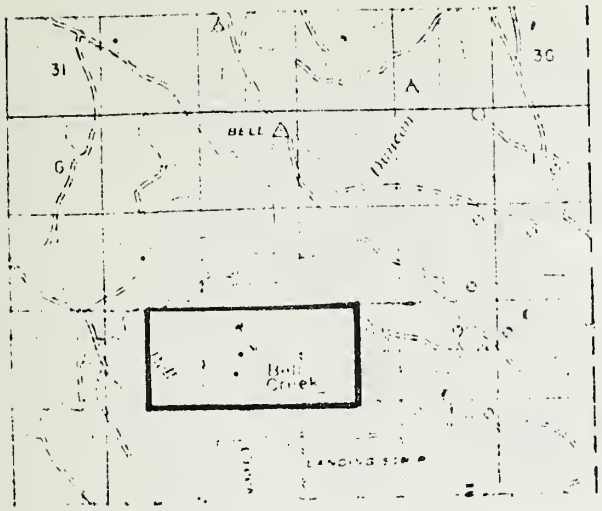


The ASHLAND - ST. LABRE (pop. 531), system was constructed two years ago and is currently operating as a nondischarging 2-cell lagoon system expandable into a 3-cell system if the community grows.

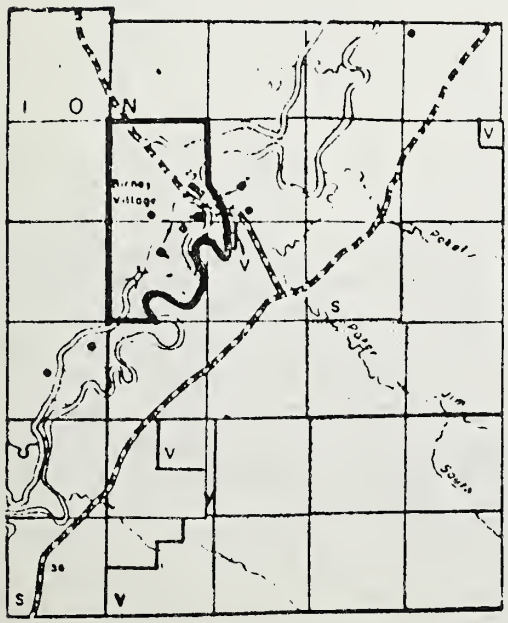
The ASHLAND CLUSTER (pop. 100), of homes utilizes a 2-cell lagoon system which occasionally discharges to the Tongue River. A third cell may be necessary, but a major expansion of the system is not anticipated.



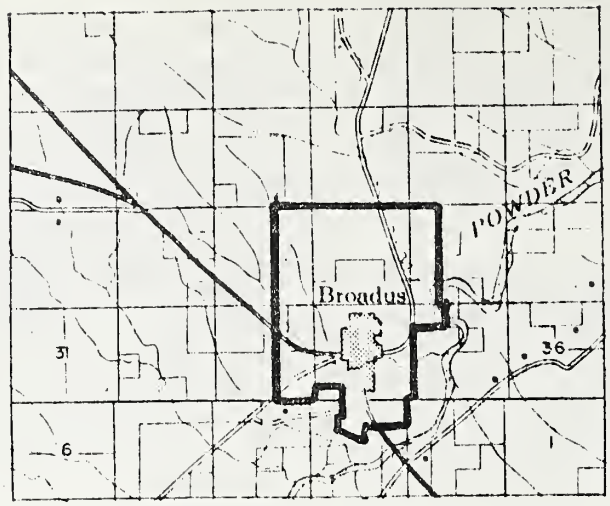
The City of Baker (pop. 2,584) operates a 3-cell lagoon designed for 3,000 people. Construction has begun on a locally planned fourth lagoon cell to facilitate storage and evaporation. The YTAPO funded a facilities planning effort for the City of Baker and the surrounding area. The study began in March, 1977, at the request of the Fallon County Commissioners and was completed by October, 1977. At least one subdivision is on septic tanks, and renewed oil activity has pressured development. Also, a small coal field lies nearby with potential for economic development. However, the city is reluctant to include adjacent developed areas within its service area.



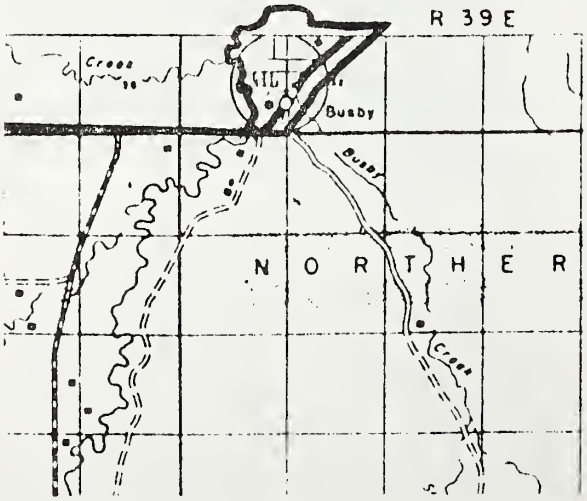
BELLE CREEK (pop. 300) is a company operated community, with sewer and water provided by Gary Operating Company. Sewage treatment is accomplished with a 2-cell lagoon. The town is less than 10 years old and was formed during the oil boom which is still responsible for its existence. Trailer court space is available for possible expansion. Gary Operating has been granted funds from the Energy Research and Development Administration for tertiary recovery study. This could influence growth in the area.



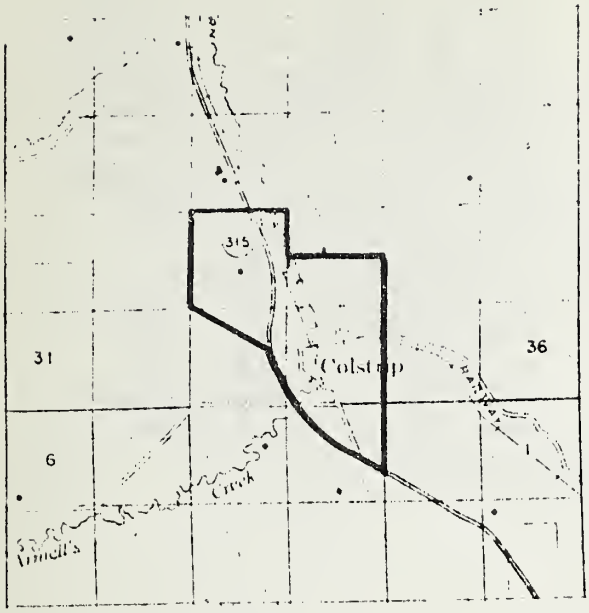
BIRNEY VILLAGE (pop. 90), is a community in the southeastern corner of the Northern Cheyenne Reservation, situated along Tongue River. Birney is served by a public water supply system but no public sewer systems. Plans are underway to construct a sewage lagoon system to serve Birney residents.



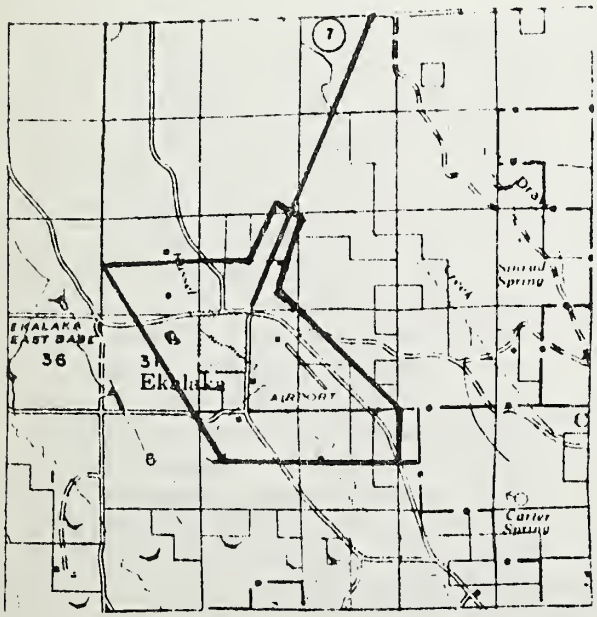
BROADUS (pop. 799) is one of five communities in the 208 area for which a facilities plan has been completed. A 3-stage development plan has been developed for different levels of growth anticipated for Broadus. Stage one being historical growth trend; stage two as moderate growth due to coal activities; and stage three for rapid growth due to energy conversion. Presently a 2-cell lagoon designed for 650 people serves the community. The town has indicated it will expand its present 2-cell lagoon system.



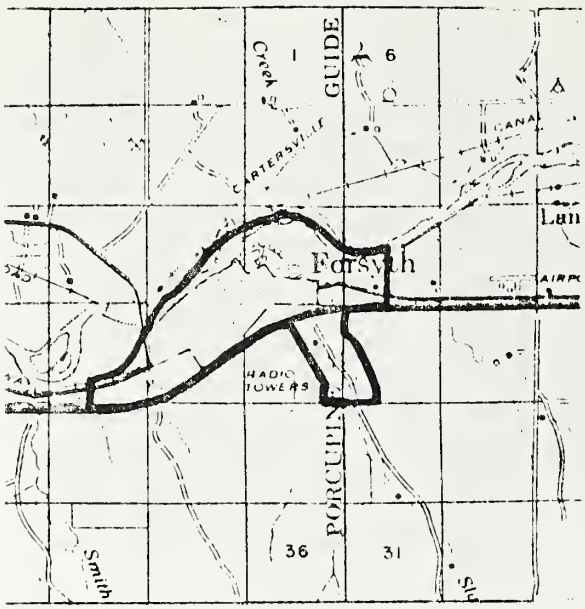
BUSBY (pop. 300) has a 2-cell lagoon which may need modification in the near future. The population of the community is gradually increasing and it appears that the existing system will not be able to meet discharge standards.



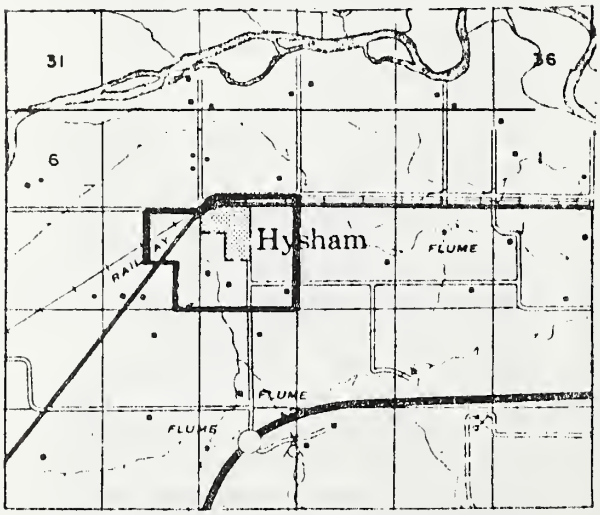
COLSTRIP (pop. 2,100 in 1975) is a company-owned town with publicly-owned (Rosebud County) sewage treatment facilities, and has a private consulting firm doing its own planning. Its present owner, Western Energy, has plans of divesting its interest in the town of Colstrip, changing it to a totally public entity in the future. Colstrip's 3-cell lagoon will soon be replaced by an oxidation ditch. Future growth or decline is very much dependent on government and company decisions to build additional energy conversion units or expand coal mining for export.



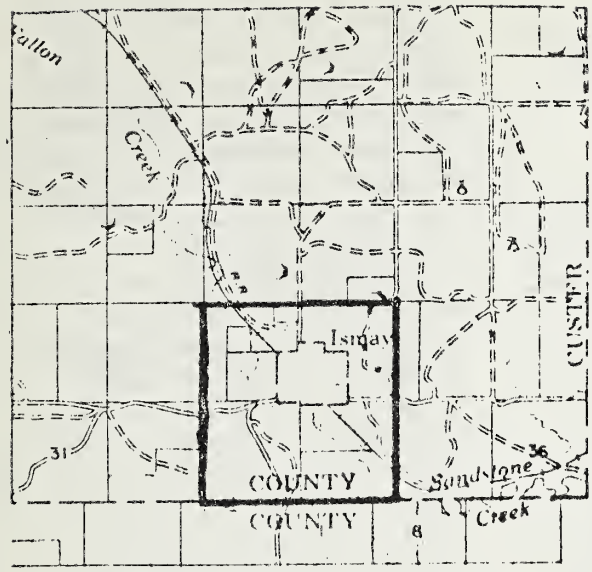
EKALAKA (pop. 663) is the only town in the 208 area that uses an activated sludge sewage treatment plant.
The plant has had several maintenance problems involving pumps, piping, building, and correct operation. The plant has been repaired and is now operating as designed. A separate clarifier is not used before discharge to Russell Creek which results in a rather high concentration of suspended solids. However, due to its ephemeral characteristic, the creek has no fishery and downstream use is limited to private stock watering. Thus, it is doubtful that the high total suspended solids will create a problem.



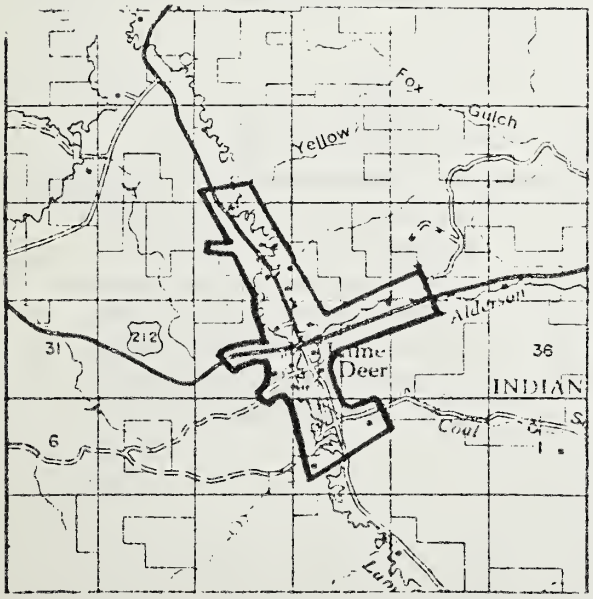
FORSYTH (pop. 2,449 in 1975) was the first community to request funds for facility planning. A severely impacted area, its population has grown nearly 50 percent since 1970. The study has been completed and Forsyth will be building an oxidation ditch designed for a population of 4,000. Operations at the Colstrip coal mine and conversion complex have been the major influences on growth.



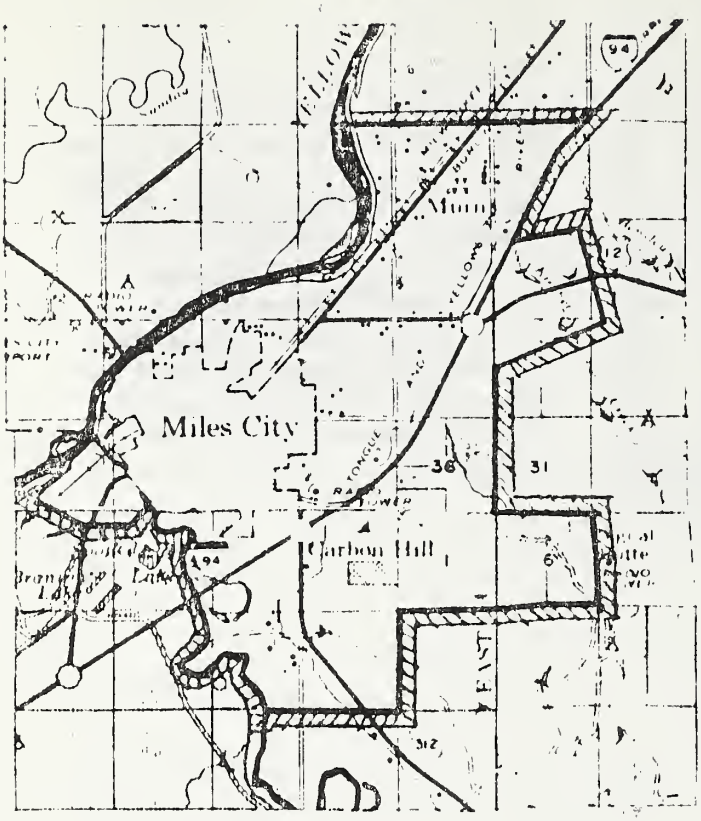
HYSHAM (pop. 617 in 1975) started to upgrade its water supply and sewer systems during the spring of 1977. Initial investigations of the sewer systems indicated that an excessive amount of infiltration was taking place. Coal tax funds were obtained to reconstruct part of the sewer system and additional engineering studies are in progress. These studies will determine if the present 2-cell lagoon is now adequate (a reduction in flow resulted from repairing the sewers), or if a new system will be required to handle the expansion the town has undergone.



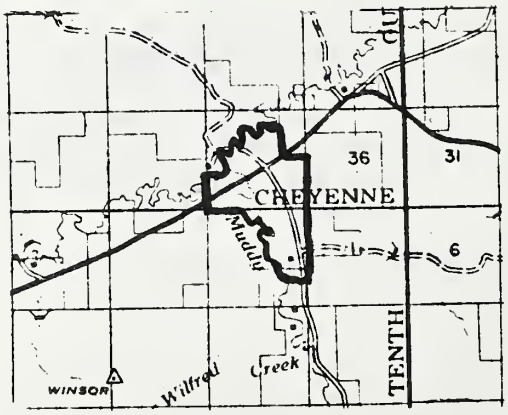
ISMAY (pop. 40) is situated on O'Fallon Creek between Baker and Terry, with no plans to centralize sewage treatment. Should coal development take place in southern Fallon County, growth could exceed past trends. However, it seems likely that population inflows will tend to gravitate towards the more established communities in the area.



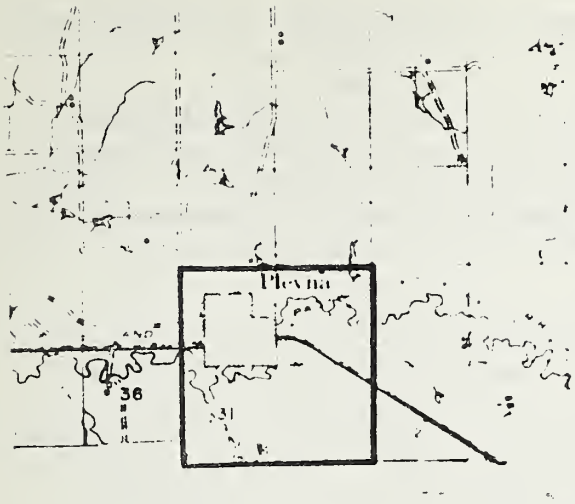
LAME DEER (pop. 650) has a 3-cell lagoon system which is operating at or above its design capacity. The effluent is relatively good but is believed to be 75% groundwater which is seeping into the lagoons. A new system, probably aerated lagoons, is being planned.



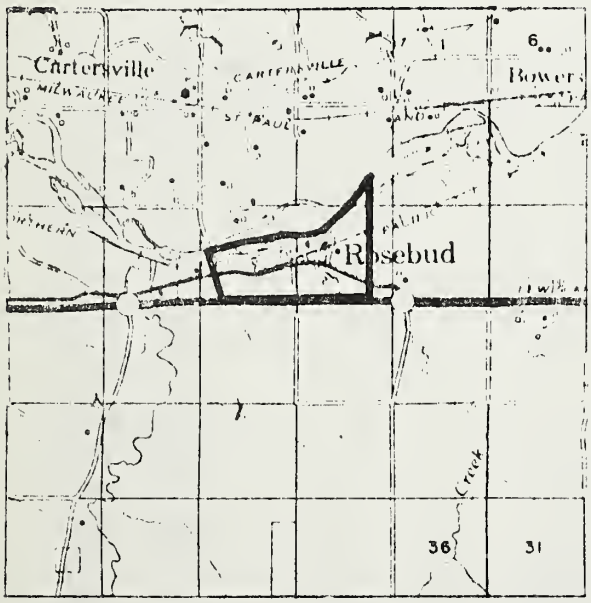
MILES CITY (pop. 9,023) the largest city in the Yellowstone-Tongue 208, started a 201 study before the YTAPO was established. The study has been expanded to include a larger area, delineated on the map, in order to arrive at a regional solution to growth problems in the Miles City area. A sewer and water district was formed in May of 1976 to handle growth problems to the south and east of Miles City that would result from subdivisions, high groundwater due to irrigation and alluvial water tables, poor drainage, and political maneuverings in the city and county. The city presently operates a 3-cell lagoon which is inadequate. An oxidation ditch which will accomodate growth up to 18,000 people in the areas delineated above, has been designed.



The MUDDY CREEK (pop. 100) homesites utilize a 2-cell lagoon system. The system is nondischarging and there does not appear to be any problem from some present seepage.



PLEVNA (pop. 189) operates a 2-cell lagoon, which seldom discharges. The system seems to operate satisfactorily and the 208 staff does not anticipate rapid growth for Plevna. Should energy development take place, Baker would be most likely to feel the impact of development before Plevna. This would give the area time to develop a workable plan for expansion.



The community of ROSEBUD (pop. 225) does not have a centralized sewage treatment system. The community will construct a centralized sewer system to be funded mainly by HUD. A facultative, nondischarging lagoon will treat the wastewater to be used for irrigation of an adjacent hay field. Rosebud is within driving distance of Colstrip and has a large number of undeveloped lots west of the existing town.

PRIORITY SYSTEM

The State of Montana has developed a point system for determining the priority by which municipalities shall receive cost-share funding for wastewater treatment facilities. Using this system, the priority list shown in Tables 25 and 26 was developed by the YTAPO staff. The list, however, reflects priority as a function of need and eligibility as defined in PL 92-500. Many of the communities in Southeastern Montana lack the eligibility because their growth has taken place since 1972 or they are awaiting uncertain future expansion. It is recommended that a second priority list be developed which realistically evaluates the needs of these communities.

From a water quality planning viewpoint, it is critical that sufficient wastewater treatment capacity be available at or before the time of significant population increases. This is contrary to the idea of cost-share funding provided by PL 92-500. Montana has had the foresight to provide, in theory, for just such cases through the coal tax system. By whatever means facilities planning and construction are funded, a priority list of needs should be developed. Through discussions with the Board of Directors, Technical Advisory Committee, and other interested individuals, this list has been developed and is presented in Table 27.

ASSUMED SITUATION AS OF JANUARY 1, 1978

YTAPO CONSTRUCTION GRANT PRIORITY LIST

(SITUATION AS OF OCTOBER 1, 1977)

Table 25.

	Stream* Segment	Water$^{\Phi}$ Use	Population Served	Scope of Project	Facility Plan Approval	Total Points
Miles City**	6	2	3	40	10	61 (61)
Forsyth**	6	2	2	30	10	50 (50)
Baker +	6	2	2	30	0 (10)	40 (50)
Broadus +	6	2	1	30	0 (10)	39 (49)
Hysham** +	6	2	1	30	0 (10)	39 (49)
Lame Deer	6	1	2	30		40 (40)
Busby	6	2	1	30		39 (39)
Ekalaka	6	2	1	25		34 (34)
Miles City Sewers	6	2	1	15		24 (24)
Ashalnd-St. Labre	6	2	2			10 (10)
Colstrip	6	2	2			10 (10)
Rosebud**	6	2	1			9 (9)
Alzada	6	2	1			9 (9)
Ashland Cluster	6	2	1			9 (9)
Belle Creek	6	2	1			9 (9)
Birney Village	6	2	1			9 (9)
Ismay	6	2	1			9 (9)
Muddy Creek Homesites	6	2	1			9 (9)
Plevna	6	2	1			9 (9)

*All stream segments were classified as effluent limited with respect to BOD_5.

$^{\Phi}$Utilizing present system. The YTAPO will recommend modifications of the classification.

**Discharge upstream from city utilizing river water for drinking supply.

+Upon approval, will receive additional points.

By January 1, 1978, and without the help of construction grant monies, the following is assumed:

Rosebud will have built a collection and treatment system; Ashland will have completed a collection and treatment system; Baker, Broadus, and Hysham will have approved facility plans.

Table 26 Construction Grant Priority Rationale, Assumed Situation as of January 1, 1978.

Miles City	61	In Step II, Designs & Specs., will be constructing oxidation ditch in FY '78. Population greater than 10,000.
Forsyth	50	Step II, also constructing an oxidation ditch in FY '78.
Baker	50	Step I, may require Step II and Step III funding in FY '78.
Broadus	49	May require Step II and Step III funding in '78.
Hysham	49	Step I in process; doing detailed I & I study; may require Step II & III funding in '78.
Lame Deer	40	Plans and specs completed by Indian Health Service. Construction funds available from IHS possibly by FY '79.
Busby	39	Funding for any upgrading would most likely come from IHS.
Ekalaka	34	No Step I done or in process. Presently operating an activated sludge plant.
Miles City Sewers	24	Will be constructed in conjuntion with treatment system.
Ashland-St. Labre	10	Recently completed construction of a 2-cell lagoon. Plans include an additional cell should it be needed.
Colstrip	10	Constructing oxidation ditch treatment system.
Rosebud	9	System under construction with assistance from HUD and coal tax.
Alzada	9	Individual systems, no discharge.
Ashland Cluster	9	Will build a third cell to provide secondary treatment. Funds provided by Public Health Service.
Belle Creek	9	Two-cell lagoon -- no changed planned.
Birney Village	9	Individual systems, no discharge. Will construct a lagoon system.
Ismay	9	Individual systems, no known plans for centralization.
Muddy Creek Homesites	9	Have a non-discharging lagoon system.
Plevna	9	Two-cell lagoon which seldom discharges -- no change planned.

Table 27.

Wastewater treatment priorities developed qualitatively, using the judgement of local government officials with regard to the degree of impact and the ability of each community to meet the treatment needs.

Criteria: Adequacy of existing system, assuming no growth of the area served.

Potential for the existence of a health hazard.

The probable contamination of ground and surface waters by the existing system.

The number of people facing physical or economic hardship due to the lack of expanded facilities.

The need for orderly development of the proposed system.

Ranking:

1. Miles City - modification of existing facilities.
2. Forsyth - expansion of existing facilities
3. Baker - modification of lagoons and expansion of service area.
4. Miles City - Haynes Avenue Sewer - expansion of service area.
5. Hysham - modification of existing facilities.
6. Broadus - correction of discharge problems.
7. Lame Deer - upgrade system.
8. Busby - upgrade system, acquire an NPDES permit.
9. Broadus - expansion of service area.
10. Ekalaka - replacement of activated sludge unit.
11. Plevna
12. Belle Creek
13. Ismay
14. Ingomar
15. Alzada
16. Birney

SPECIAL NEEDS

Since the beginning of facilities planning for Miles City, there has been a recognized need for expansion of the wastewater collection system to serve the Haynes Avenue area. This need has been acknowledged during review processes of the Water Quality Bureau and EPA, but considerable debate has been generated as to eligibility for cost-share funding. As a result, there have been a number of delays in providing a needed service. Private investors, expecting funds to be made available through construction grant monies or coal tax grants, have avoided funding the project. At the same time, and again expecting the system to be expeditiously developed, the number of subdivisions scattered around the eastern and southern edge of Miles City has grown. Residents of these subdivisions have resorted to septic tank systems -- some in clay soils or areas of high groundwater and temporary lagoon systems. In addition, large areas which could more rationally serve the needs of Miles City are left undeveloped for lack of a centralized collection system.

The City, Custer County, Coal Tax Board, Water Quality Bureau, EPA, and private investors need to organize an effort to coordinate this project. The size of the community, its location relative to the Tongue and Yellowstone Rivers, and the high water tables in the area necessitate a well developed and expeditiously implemented plan. Besides the 201 Facilities plan, the Custer County Water and Sewer District has developed an updated plan for water and wastewater needs.

It is recommended that the Miles City-Haynes Avenue sewer system be given a high priority for future funding through eligible construction grant monies and assistance for the remaining costs through the Coal Tax Board.

The YTAPO has suggested that a new town situated in the center of the major coal fields area may have many advantages over expanding existing communities to meet the needs of industrial development. While not considering this as a priority item, the idea merits the consideration of the coal tax board. This new town would minimize the need for each community to upgrade their facilities including law enforcement, business, cultural, educational, transportation, and water to accomodate a fluctuating population. It could centralize the industrial population so regular bus schedules could be developed for workers going to and from different project areas. Water and wastewater systems would be developed for only one community and could be planned from beginning to end to meet the needs of both transient and permanent populations.

Considerably more extensive development would need to occur before a community of this sort would be feasible. However, now is the time to look and plan towards minimizing the impact of that development.

PERMIT CONDITIONS

There are a few modifications of the present waste discharge permit system which seem necessary. One of these is the allowance on a case-by-case basis of up to 100 mg/l total suspended solids. The Water Quality Bureau has given tentative approval of this pending permission through the NPDES. This allowance will greatly help many of the smaller communities meet discharge standards with their present facultative lagoons while sufficiently protecting receiving drainages from degradation. The remaining changes are specific to individual communities in the project area.

There is concern if a continuous discharge is allowed from an oxidation ditch treatment facility at Colstrip, anaerobic conditions in the East Fork of Armells Creek during critical flow conditions may result. It is recommended an inspection of downstream conditions be made during compliance monitoring to determine if there is any evidence of anaerobic conditions or other degradation of the stream.

Ekalaka is in a unique situation of a small town using an activated sludge process. It discharges continuously to a small drainage, Russell Creek, which otherwise is normally dry. Within the last year, Ekalaka has installed some new equipment to patch up their aging system. Their plant is now operating as designed. The discharge does not meet secondary standards and will not unless substantial upgrading is done. Since the Town of Ekalaka has made a responsible effort to treat its wastewater during the last two years and Russell Creek has not been degraded to the point that residents of the area have complained about its condition, the 208 Project recommends that the correction of the current conditions at Ekalaka be given low priority unless a health hazard arises.

The effluent from the treatment facility should be chlorinated to eliminate the danger of pathogenic organisms in the drainage the facility is discharging to. The condition of the chlorination facilities and the drainage downstream from the treatment facility should be inspected during each compliance monitoring visit by state officials.

An interim goal (as opposed to official permit requirements) of a discharge of no more than 50 mg/l BOD_5 and 50 mg/l TSS is recommended.

PRIVATE DOMESTIC POINT SOURCES

A number of domestic wastewater discharges have been identified during the 18 months of plan preparation. Most of these were brought to the attention of the YTAPO by public officials or were discovered by staff members while doing unrelated field work. These discharges and their current status is discussed below.

In the Miles City area several problems exist concerning private domestic wastewater discharges. Several houses have inadequate septic tank drainfields resulting in seepages to the Haynes Avenue drainage ditch. At least three houses discharge partially treated sewage directly to this ditch. The problem has been acknowledged by the city/county planner and the county sanitarian, as well as the YTAPO, and is expected to be abated when the Haynes Avenue sewer line is installed as described in the 201 facilities plan for Miles City.

One year ago, the YTAPO was informed of a sewage discharge of partially treated wastewater originating from the Aye Subdivision south of Miles City. Since then, a dike has been constructed to prevent that discharge, allow further treatment, and allow final disposal by evaporation and percolation. However, the lagoon appears to be undersized and poorly constructed allowing seepage to occur through the dike and into an old oxbow of the Tongue River. This was witnessed on June 8, 1977, by a YTAPO staff member. The county sanitarian is aware of the situation. If preventive measures are not taken in a year, further action will be discussed in the revised 208 plan.

Because of the diligent efforts of various people, a number of problems have been cleared up, at least temporarily. The Crossroads Inn had a problem with a mound system which discharged partially treated wastewater seeping into an irrigation ditch. Inspection on June 8, 1977, showed this was no longer the case. This abatement may be due to an extended dry season and should be monitored by the Custer County Sanitarian to ensure that the resurfacing problems does not recur.

The C&L Trailer Court had similar resurfacing problems from a septic tank system. This, too, has apparently been corrected. The ground between the septic tank drainfield and the Miles City slough storm water drainage system is soft due to wet soils immediately below the surface. This system should also be closely monitored to see if the situation has been permanently corrected.

The Anderson Apartments, north of the Yellowstone River and north of Miles City, has a septic tank treatment system which discharges its partially treated wastewater to a surface drainage way. This wastewater ponds in two connected pools (ponds not fenced) and then runs down several hundred yards of steep terrain. Originally, this water ran directly into the Yellowstone River until Mr. Anderson was notified by the Water Quality Bureau (1976) to correct the problem. Since then a dike has been built about 50 feet above the dirt road running parallel

to the Yellowstone River. There was no discharge as of June 8, 1977. Water in the pond was about two or three feet deep and the dike had about 3 feet of additional free board at the time. There is no discharge device other than a crude dirt spillway at one end of the dike. The pond should be capable of holding about 0.5 - 1.0 acre-feet which appears to be adequate for the amount of sewage to be retained. However, the drainage blocked by the dike is probably 20 or more acres in size with steep, easily erodible terrain. Should a thunderstorm of even moderate intensity develop, the reservoir would quickly fill, overflow, and very possibly wash out the retaining dike, thus discharging the sewage to the Yellowstone River.

Brewer's Trailer Court, west of Forsyth, is the site of another wastewater resurfacing problem. Partially treated domestic wastewater is conveyed via plastic pipe buried in a gravel trench. The pipe itself surfaces to cross a gravel road through a culvert and enters another gravel trench. The trench extends about 110 meters west to a swampy area next to a railroad fill. At the time of inspection, grayish water was setting in gravel-pock holes and a black sludge was deposited next to the foot of the trench outcrop. No pipe exits from the trench but the water looked and smelled of sewage. The Rosebud County Sanitarian is well aware of this problem and is actively seeking its correction.

Another trailer court adjacent to Butte Creek in Rosebud is discharging partially treated wastewater. The water resurfaces and flows down the bank of Butte Creek. It is assumed that this problem will be corrected when the community of Rosebud installs its planned central sewer system.

According to the former Custer County Sanitarian, two houses in the Stand Hope Addition near Baker discharge partially treated wastewater to pits. Occasionally these pits will overflow and discharge into a ditch. The problems with tight soils and septic tank failures around Baker were the main concerns voiced by the Fallon County Commissioners when the YTAPO was requested to initiate a facilities plan for Baker and the surrounding areas. This plan will outline the corrective measures necessary to alleviate these problems.

If a private domestic discharge exists, it is recommended that the Water Quality Bureau remain the agency responsible for regulating these point sources. The legal responsibility for proper disposal of domestic wastewater will remain with the discharger. The enforcement of existing laws concerning discharges and their permits will be enhanced by responsible sanitarians, county planners, and other public officials by keeping information readily available to the public and by continual vigilance for domestic waste disposal problems.

INDUSTRIAL POINT SOURCES

As of August, 1975, 21 industrial permits were active within the YTAPO area. Since that time the majority of these (18) permits allowing Gary Operating to discharge saline water separated from produced oil have been discontinued as of July 1, 1977. Gary Operating is refitting the Belle Creek field to totally inject the produced water.

The current permits are listed in Table 28.

Table 28. Industrial Discharges

Discharger	Source of Water	Permit Number	Comments
Peabody Coal Co.	Groundwater seepage into mine.	MT-0000884	Discharges to Miller Coulee
Shell Oil Company	Injection system	MT-0000329	Discharges only during emergencies, as equip. failure
Shell Oil Company	Treating plant	MT-0000311	As above
Union Texas Petroleum	Gas Plant	MT-0023752	Intermittant discharge--cooling water

Shell Oil Company, which operates the portion of the Cedar Creek Anticline in Fallon County presently has two permits which are active. Peabody Coal has been issued a permit to discharge excess water from its coal mining operation. A major portion of industrial water is produced and used in the production of oil.

It is recommended that industrial wastewater discharge permits continue to be administered by the Water Quality Burau. Compliance monitoring shall be continued by that agency. Municipalities and counties receiving industrial wastes for treatment within public wastewater treatment systems shall be responsible for enforcing adequate pretreatment before being discharged to their respective systems.
Local governmental bodies are also in an ideal position to identify industries that should maintain a discharge permit. While they may not be under legal obligation to report these discharges to the enforcement agency, the Water Quality Bureau, they should be particularly careful that industries within their boundaries are aware of permit requirements and any discharges are recognized and allowed by the Montana Department of Health and Environmental Sciences (MPDES).

Several categories of industrial wastewater are produced in Southeastern Montana. Saline water, ranging from 2,000 - 5,000 mg/l TDS, are co-produced with oil in oil fields. The quantity of water produced varies considerably from well to well. Some units now produce more water than can be allowed to evaporate or seep away. Depending upon the oil bearing zone, this supply of water may be economically reinjected in a water flooding scheme in secondary recovery operations. If this is not practical and the wastewater must be discharged, a permit must be obtained outlining the limits to be met in order to comply with the water quality standards set by the State of Montana.

Electrical generation at the Colstrip facilities involves cooling tower, scrubber, and ash-carrying wastewaters. It is the policy of the state to allow no discharge of these types from any new plants. It is recommended that this policy continue, especially concerning scrubber and ash wastewater.

Gravel washing operations currently use settling pits to remove most of the settleable solids before discharging any excess water. It is usually a rather simple procedure to recycle this water for continual washing, thus eliminating a need for discharge.

Seepage water pumped from strip mines will occasionally exceed that usable by the mining operation and is now discharged occasionally. The permits regulating these discharges should evaluate the possible degradation of receiving waters due to a high mineral content and heavy metals.

Hospitals are usually connected with municipal wastewater systems and have the potential to discharge a large quantity of bacteriocides and cleansing agents which could cause a significant shock load to a treatment system. It should be the responsibility of the respective municipality to ensure that adequate pretreatment of these wastes exists. Such pretreatment could be as simple as dumping over a longer period of time rather than dumping large loads in a short time.

The dumping of septic tank pumpage or holding tanks into municipal sewage systems may cause adverse effects under some conditions. Packing plants, garages, and other small commercial operations each possess unique types of contaminants which must be evaluated on a case-by-case basis.

URBAN RUNOFF

Only two communities in the project area have discrete stormwater discharges. These are Miles City and Colstrip. Forsyth has completed a stormwater management plan and intends to develop a conventional system. Several sets of samples were taken at discharge points in Miles City to attempt to evaluate the impact of this city, the largest in Southeastern Montana, and adjacent to the Tongue and Yellowstone Rivers. In general, BOD loadings were usually less than 10 mg/l and total suspended solids less than 100 mg/l. Several discharge points were consistently high in fecal coliform, indicating a large flush of fecal matter to both rivers. Dissolved oxygen, pH and conductivities were generally within acceptable limits.

Relating this summary of sample results to the overall stream system is essential in drafting a permit system for urban runoff. The worse case situations, those involving heavy thunderstorms, flushing city streets into the streams, also contribute a tremendous nonpoint source load from construction, agricultural, and natural sources. Total suspended solids greater than 1000 are not uncommon for these types of runoffs. The extensive amount of surface runoff from a thunderstorm area tends to dilute an area even as large as Miles City, thus making its contribution negligible.

Because of the relatively small amount of urban runoff involved in communities in Southeastern Montana, it is recommended that a general permit be issued to all those communities within the YTAPO project area.

In the case of Miles City and Forsyth which discharge essentially to the Yellowstone River, additional monitoring of fecal coliform and fecal/strep ratios should be done to evaluate the impact this would have on the Yellowstone River. If is is determined that a health problem might result from discharge of urban runoff, then individual permits should be issued to those communities where a problem could exist. These permits would itemize the conditions and treatment necessary for discharge of that wastewater.

AGRICULTURAL POINT SOURCES

Two basic types of agricultural point sources were described under the original discharge permit program -- feedlots and irrigation return flows. The definition of both sources has been changed by recent court and legislative action. Feedlots of over 1,000 head of cattle and those smaller units that contribute contaminants to state waters via a ditch or other definable conveyance are required to have discharge permits. A general permit system was proposed for irrigation return flows but never fully implemented prior to a modification of the enabling legislation by Congress. Irrigation return flows now come under the nonpoint source management process instead of the discharge permit program.

Several discharge permits have been issued for agricultural point sources within the boundaries of the YTAPO 208 Project. Due to the modification of the enabling legislation, prior recommendations for general permits for irrigation return flows have been abandoned.

The Agricultural Report contains recommendations for the application of Best Management Practices to irrigated cropland for the reduction of salinity, sediment and nutrient levels in return flows. Part of this Best Management Practices program is the development of an awareness of the possible impact of salinity on irrigation and the establishment of a self-help program for the monitoring of irrigation water sources and return flows and the use of this information in the management of irrigated agriculture.

The Agricultural Report also contains information on Best Management Practices for the control of livestock wastes from confined and open feeding operations. There are only a few classic feedlots within the YTAPO Project area. Most of these are located in such a way as to not contribute wastes to streams except under extreme precipitation events. The exceptions to the above comments will be asked to proceed with voluntary corrective actions during the first year of the implementation of the 208 Plan. If voluntary corrective actions are not adequate, the locations and names of the owners will be referred to the Water Quality Bureau during the first revision of the 208 Plan.

GENERAL PERMITS, IRRIGATION

Irrigation has been and is likely to continue to be the prime use of water in Southeastern Montana. A total of 119,980 acres (Table 29) are irrigated, either by flood, sprinkler, or water spreading systems. Using an average of two feet of water applied annually to this acreage, this represents a consumption of 240,000 acre-feet per year, or 320 cfs on a year-round basis. Actual diversions range from 50% to 150% higher depending on individual management practices. The Yellowstone and Tongue River bottom lands are the only lands capable of receiving full service irrigation, i.e., have water available at all times to meet crop requirements. These areas have highly developed irrigation systems and several formal irrigation districts. Crops include corn, beans, beets, alfalfa, and cereal grains. The main type of water application is flooding although pivot sprinklers are becoming increasingly popular. On the upper Tongue and the entire Powder River mainstem, hay is the predominant irrigated crop. Flooding onto diked fields is common with little surface runoff. The remaining irrigation is almost totally for hay production.

In the smaller watersheds, water is diverted from ephemeral creeks and spread onto contour diked hayfields. Only during exceedingly heavy runoff is any water discharged via surface runoff to the original drainage.

During the 1976 and 1977 irrigation seasons, the YTAPO staff and consultants to the project collected samples of irrigation return flows. The first season's sampling investigated sediment, salinity, and nutrient concentrations in irrigation waters above and below specific fields. The results of this sampling were generally inconclusive due to the timing of sampling. This information is presented in the Agricultural Report: Irrigated Croplands. The latter season's sampling investigated surface runoff where it actually entered the Yellowstone and Tongue Rivers. The results are presented in Table 30.

Although all of these measurements were taken from surface flows, a large proportion of this water seems to originate from subsurface drainage of irrigated cropland recharging the drainage ditches. The temperatures and ranges of conductivities of known groundwater seeps matched well with a number of surface drainages to both rivers. This investigation attempted to locate all discrete surface discharges in every irrigation district in the project area. During the period of July 26 to August 4, all of these drainages were checked a second time, with a total discharge of less than 40 cfs. This was 5% to 10% of the total amount of water being diverted in those districts at that time. If one estimates that 50% of the water being diverted is consumed by evaporation and transpiration, and that another 10% returns to the river as surface runoff, the additional 40% of the diverted water thus returns as an underground flow.

This 40% is considered a nonpoint source and, as such, is not regulated by the MPDES. Since most surface runoff is difficult to trace to a single operator and is basically a nonpoint type of problem, it is not felt that a system of individual permits is practical. If in the future, a particular system has a discharge that could conceivably degrade state waters, then an individual permit should be issued for that discharge. It is recommended that Best Management Practices be used as guidelines for reducing the impact of irrigation on surface and groundwaters. Management is the key for tackling both underground drainage and surface runoff.

Table 29 Estimated Impact of Sediment Yield in Relationship to Irrigated Crops in Southeastern Montana.

County	Cereal	Corn	Beets	All Hay	Beans(1)	Total
Carter						
Acres	2,200	0	0	7,700	0	9,900
Sediment Yield	1,870			246		2,116
Custer						
Acres	7,000	8,740	2,630	7,900	100	26,370
Sediment Yield	5,950	17,628	3,616	252	40	27,486
Fallon						
Acres	200	0	0	4,200	0	4,400
Sediment Yield	170			134		304
Powder River						
Acres	200	200	0	16,170	0	16,570
Sediment Yield	170	403		517		1,090
Rosebud						
Acres	13,400	9,720	1,280	21,000	400	45,800
Sediment Yield	11,390	18,605	1,760	672	160	33,587
Treasure						
Acres	3,200	4,700	3,540	4,100	900	16,940
Sediment Yield	2,720	9,480	4,867	131	3,600	20,708
Total Acres	26,200	23,860	7,450	61,070	1,400	119,980
Net Soil Loss lbs/acre	1,700	4,035	2,750	65	11,600	
Net Soil Loss Tons/ /yr	22,270	48,140	10,243	1,984	8,120	90,757

(1) Net soil loss lbs/ac. were taken from Dr. J. Bosch's work in Idaho.

Table 30 Irrigation return flow samples.

Sample Name	Location	1977 Date Sampled	Time	Sample Number	Temp. °C	Flow	Conductivity (umhos) Field	Conductivity (umhos) Lab	TDS	SAR	NO_3 as N	PO_4 as P	TSS	Ca	Mg	Na
T & Y #1	8N47E12BB	6-29	1215	01	21.5	100 gpm	750	1220	780	4.84	0.37	0.02	12.6	55.9	36.1	188.9
T & Y #2	8N47E01AC	6-29	1300	02	23	2.13 cfs	1250	820	524	2.12	0.39	0.05	3.00	31.32	34.58	72.22
T & Y #3	9N48E30AB	6-29	1400	03	26.5	80 gpm	950	880	563	1.68	0.39	0.33	3.64	61.9	34.6	66.7
T & Y #4	9N47E36CA	6-29	1420	04	26	100-150gpm	900	860	550	1.75	0.48	0.13	115.4	64.29	39.06	72.22
T & Y #5	8N47E06AB	6-29	1430	05	25	2.61 cfs	850	850	544	1.77	0.39	0.04	112.0	62.2	39.06	72.22
Kinsey #1	10N49E30AD	7-5	1015	06	22	3 cfs	750	760	486	3.50	3.4	0.27	137	44.5	25.3	118.0
Kinsey #2	10N49E31BD	7-5	1045	07	24	1 cfs	550	560	358	3.29	0.6	0.14	126	33.6	22.1	100.1
Kinsey #4	9N48E09DD	7-5	1130	08	25	200 gpm	650	2200	1408	9.11	7.85	0.19	21.0	70.8	45.6	400.0
T & Y #7	9N48E17CA	7-5	1330	09	26	2.5 cfs	600	550	352	1.51	0.25	0.24	21.1	42.9	23.0	55.0
T & Y #6	8N47E23AA	7-5	1415	10	26	5 cfs	500	530	339	1.40	0.35	0.08	120	41.4	33.8	50.0
YID #5	6N37E05DB	7-6	0900	11	17	1.2 cfs	1000	1170	748	3.59	2.35	0.16	8.4	55.3	62.6	164.0
YID #6	6N36E05AAA	7-6	0945	12	14	.5 cfs	1850	2200	1408	8.73	7.25	0.21	4.0	63.0	58.3	400.0
YID @ Armells Cr.	6N39E23CBD	7-6	1100	13	22	15 cfs	450	460	294	1.67	0.05	0.16	101	36.7	22.1	52.0
YID #7	7N36E32DBD	7-11	0945	14	10	3cfs	500	540	345	2.40	0.07	0.24	1568	41.4	24.3	67.0
YID #9	7N36E33CAC	7-11	1115	15	25	30 gpm	500	485	310	1.83	<0.02	0.22	20.8	38.2	23.2	58.0
YID #10	7N36E36CCB	7-12	0930	16	16	100 gpm	650	740	473	2.28	<0.02	0.32	1.05	61.5	29.6	87.0
YID #11	6N37E06AD	7-12	1040	17	22	50 gpm	500	520	332	1.71	<0.02	0.27	111	39.8	23.2	55.0
YID #12	6N39E18Ca	7-14	0900	18	16	200 gpm	1050	1300	832	5.54	0.50	0.48	7.8	56.9	34.7	214.8
YID #13	6N37E12ADB	7-14	0945	19	17	1 cfs	650	740	473	2.20	<0.02	0.21	101.7	56.9	24.4	78.6
YID #4	6N37E11BBA	7-14	1030	20	17	3 cfs	850	1000	667	3.22	0.25	0.34	41.9	62.67	35.6	138.05
Hammond #1	6N39E10BBD	7-14	1330	21	24	1 cfs	600	530	339	1.70	<0.02	0.09	5.4	40.70	18.32	52.15
Myers #1	6N35E15BC	7-15	0930	22	21	4 cfs	400	410	262	1.20	<0.02	0.23	69.9	33.17	13.12	32.98
Myers #2	6N35E11BD	7-15	1015	23	21	5 cfs	350	430	275	1.34	<0.02	0.22	65.8	33.77	14.12	36.81
Myers #3	6N35E11BA	7-15	1115	24	20	2 cfs	1700	1800	1152	8,76	0.19	0.32	17.7	64.98	25.14	352.8
Rosebud #1	6N42E15BD	7-18	0930	25	23	3cfs	650	720	460	2.50	0.17	0.16	67.0	53.42	20.66	84.75
Hammond #1-2	6N39E10BBD	7-26	0930	26	17	100 gpm	-	620	397	1.94	0.21	0.06	10.0	43.9	24.2	64.4
Kinsey #1-2	10N49E30AD	7-28	1030	27	21	1.5 cfs	1100	1180	755	5.18	4.06	0.18	526	51.94	28.40	186.6
Kinsey #2-2	10N49E31BD	7-28	1115	28	24	1.0 cfs	750	740	474	2.65	0.27	0.10	46.0	50.37	26.36	93.3
Kinsey #4-2	9N48E09DD	7-28	1230	29	21		1230	1900	1216	9.19	4.85	0.05	119	60.9	38.9	373.3
T & Y #2-2	8N47E01AC	7-29	1005	30	23	2.5 cfs	1000	980	627	3.00	0.33	0.05	89	50.1	33.7	112.1
T & Y #3-2	9N48E30AB	7-29	1115	31	24	1.5 cfs	600	590	376	1.29	0.04	0.04	4.4	44.11	32.6	46.3
T & Y #4-2	9N47E36CA	7-29	1400	32	22	100 gpm	650	630	416	1.24	0.23	0.19	10.8	44.11	34.7	45.3
T & Y #5-2	8N47E06AB	7-29	1445	33	26	200 gpm	600	550	352	1.17	0.24	0.04	82	41.77	31.6	41.0
T & Y #6-2	8N47E23AA	7-29	1530	34	25	5 cfs	600	580	371	1.21	0.48	0.09	80	43.33	31.6	43.1
YID #11-2	6N37E06AD	8-3	0940	35	21	100 gpm	700	740	474	2.22	0.10	0.45	11	56.63	31.65	84.0
YID #10-2	7N36E36CCB	8-3	1010	36	20	150 gpm	800	840	538	2.31	0.68	0.13	10.8	60.54	33.2	89.95
YID #6-2	6N36E05AAA	8-3	1045	37	16	2 cfs	1900	2200	1408	9.53	3.05	0.36	6.0	54.28	48.74	401.72
YID #7-2	7N36E32DBD	8-3	1130	38	23	3cfs	900	880	563	2.97	0.65	0.27	53	53.50	31.65	110.91
Myers #1-2	6N35E15BC	8-3	1245	39	23	8 cfs	500	530	339	1.61	0.03	0.06	56.4	38.64	23.88	51.52
Myers #2-2	6N35E11BD	8-3	1320	40	25	3 cfs	550	570	365	1.74	0.06	0.16	39.6	40.99	23.88	56.76
Myers #3-2	6N35#11Ba	8-3	1400	41	25	3 cfs	2700	2700	1728	12.38	0.82	0.17	18.7	68.76	62.72	590.32
YID #12-2	6N39E18CA	8-4	0800	42	19	1 cfs	800	860	550	3.19	0.70	0.22	62.3	46.46	33.20	116.15
YID #13-2	6N37E02ADB	8-4	0845	43	16	1 cfs	1000	1150	736	1.85	0.03	0.19	3.4	164.25	53.4	106.56
YID #4-2	6N37E11BBA	8-4	0915	44	17	1 cfs	800	980	627	2.36	0.11	0.22	53.6	52.75	44.08	96.08
Rosebud #1-2	6N42E15BD	8-4	1105	45	16	2 cfs	600	900	576	2.26	0.74	0.21	30.10	53.50	33.20	85.60

NONPOINT SOURCES - INTRODUCTION

Nonpoint sources of water pollution include erosion from fields and construction activities, salinity from irrigation and mining activities, etc. Basically, anything which cannot be traced back to a discrete pipe or ditch is considered to be nonpoint in nature.

The water quality of the major streams indicates a relatively limited volume and quality of water for the study area. This includes high concentrations of dissolved substances causing salinity conditions which adversely affect the water's use for agriculture. Sediment is also high in many of the streams. The Powder River has extreme concentrations. Intestinal coliform bacteria are common in many of the smaller tributaries that drain areas of livestock concentration. The mainstem of the Yellowstone River and the Tongue River have the highest water quality and are a significant fishery resource.

Causes of the adverse water quality can be attributed to point and nonpoint sources. The management plans developed by the Montana Department of Health and Environmental Sciences Water Quality Bureau for the Little Missouri, Lower Yellowstone, and Middle Yellowstone basins describe the point sources of the area. These are limited in number and significance. The primary sources of degraded water quality are nonpoint. These nonpoint sources are caused by natural geological conditions of the stream or are man-caused sources described in the earlier section. Unfortunately, in many cases it is impossible to determine the increase above background levels contributed by man's actions. For example, the least amount of sediment yield from rangeland will occur on an area with the most vegetative cover and the least grazing pressure. Consequently, no grazing would produce the lowest sediment yield. However, this condition would not reflect even historic range conditions as buffalo, antelope, elk and deer used the range resources before the advent of the cattle and sheep rancher. Concentrations of game animals wintering in the river valleys created severely disturbed conditions in erosion-prone areas. Prairie fires were also left unchecked and created extensive areas of bare soil that were subject to erosion before spring runoff.

This illustrates the difficulties in determining if water quality has been degraded by human interference in the natural system. Because of the large amounts of native range in the study area and the naturally high background levels of water pollutants, the Yellowstone-Tongue management program is directed at development of management practices to maintain water quality at its present state. Our concentration is to eliminate the obvious practices which contribute an inordinate amount of sediment or dissolved substances to the surface waters.

The management practices will then address human needs for water and land use, rather than abstract standards related to potential water quality of the region or historic water quality. The management practices

will also have the side benefit of maintaining long-term productivity of the natural resources of the area by emphasizing soil conservation, controlling stream bank erosion, limiting saline incursion, and other practical agricultural practices. The management plan for pollution control from non-agricultural sources (urban runoff, strip mining activities, subdivision, highway and railroad construction) emphasizes the economic considerations of improving water quality for the various alternatives. Control of sediment through erosion control practices in some of these activities often has side benefits beyond water quality in that reduced erosion reduces highway maintenance, improves reclamation of strip mined land, and provides a cleaner environment for residents of a subdivision.

Economic considerations are also important in the management plan development. For example, installation of an expensive storm sewer treatment system in a community of 50 people at a cost of $25,000 when the storm sewer contributes 1/10,000 of the total annual pollutant load to the receiving water would not be sensible. However, contour cultivation of cropland costs very little and not only eliminates pollutants from the waterways but also is economically beneficial in maintaining long-term productivity of the land. On the other hand, a community of 50 people may be required to spend the $25,000 on a water treatment system if intestinal bacteria from their community threatens the health of downstream water users with typhoid and other waterborne diseases.

The development of the management plan involves consideration of the above problems with alternatives for development and recommended actions. The development of a management plan also involves selection or development of a governmental organization to ensure the plan is implemented. Philosophies differ concerning the effectiveness of an implementing agency at the local, state or federal level. One group could consider the state or federal level most beneficial since water pollution problems created in one county affect the downstream residents of different counties and even states. To ensure the rights to quality water supplies of the downstream users are not violated, a state or federal level organization is required. On the other hand, local governments are often preferable as they generally have first-hand knowledge and can more effectively communicate with local people in explaining the water quality problems that exist. They can also be more innovative in determining the effectiveness or practicality of a particular solution to a pollution problem. Perhaps the most important factor in selecting an implementing agency is to determine which group or organization has the most cost-effective record in controlling water pollution or related problems and who has the experience and available expertise in the field being considered.

The implementing agencies of the 208 management plan will be existing organizations selected for their overall suitability and capabilities. <u>There need not be any additional regulatory agency established for the plan implementation.</u>

NONPOINT -- AGRICULTURAL

Agricultural sources contribute a large percentage of the man-induced nonpoint pollutants. But, as mentioned in the prior section, it is difficult to differentiate between man-induced and natural pollutants in Southeastern Montana. Two approaches can be utilized:

1. Man-induced pollution is in excess of what would occur naturally. The definition of natural pollution could be considered the amount of erosion that took place during "natural" episodes of overgrazing by the bison, etc. If this approach is utilized, it is probably safe to state that with a few exceptions, erosion (a nonpoint polluation source) is less now than under "natural" conditions.

2. The second approach to defining man-induced pollution is to determine if there are reasonable conservation practices which could be implemented without a major economic burden upon the property owner. Any erosion (or salinity or other problems) taking place due to the lack of reasonable conservation measures is considered to be man-induced.

While the YTAPO recognizes the rationale behind the first approach, the recommendations contained within this report will be based upon the second approach.

The Conservation Districts and the U.S. Department of Agriculture's Soil Conservation Service have supported the use of good conservation practices for many years. Those reading this report who have worked with the SCS will recognize most of the management practices described in the following pages.

Generalized management practices are described in Table 31. It is difficult to provide specific recommendations for Best Management Practices for agriculture due to variations within the YTAPO project area. For example, restricting water application to the needs of the crop and not applying an excessive amount of water would reduce the loss of nitrate from the rooting zone and assist in controlling water table and groundwater salinity problems in areas along the Yellowstone River. Also, in some areas the use of sprinkler irrigation may be a good water management practice but due to a difference in the quality of the supply water, neither of these practices should be recommended for people irrigating along the Powder River. Flood irrigation with the application of an excessive amount of water to leach the salts down through the soil is necessary on most land along the Powder. Perhaps gated pipe might provide more uniform application of the water, but the leaching of the salt below the rooting zone would remain a primary management criteria.

The differences in management practices related to dryland farming and range managment are not as noticeable, but they do exist. Management practices need to be tailored to each farm or ranch.

Table 31. BEST MANAGEMENT PRACTICES

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Stream bank and Channels	1A. Stream bank and channel erosion	1.1 Perform stream bank erosion control	1.1a Slope banks	Streambank Protection (580)
			1.1b Construct riprap	Structural Measures (580-A)
			1.1c Revegetate problem area	Vegetative Phase (580-B)
			1) with grasses 2) with shrubs 3) with trees	
			1.1d Protect problem area from livestock	
			1) by fencing	Fencing (382)
			2) by developing an alternate water supply	Pipeline (516) Pond (378-A) Spring Development (574)
			3) by changing land use	Range Seeding (550) Pasture & Hayland Planting (512)
		1.2 Perform channel erosion control	1.2a Provide diversion structure	Diversion (362)
			1.2b Remove obstructions from channel	Streambank Protection (580)
Irrigation	2A. Ditch bank and gully erosion (delivery system)	2.1 Perform reorganization of delivery system(s)	2.1a Line ditches	Ditch and canal lining (430-A-D)
			2.1b Install pipelines	Pipeline (430-AA-GG)
			2.1c Install water control structures	Structural measures (580-A)
			2.1d Install gradient control checks	Structural measures (580-A)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Irrigation (cont.)	2A. Ditch bank and gully erosion (delivery system) (cont.)	2.1 Perform reorganization of delivery systems(s) (cont.)	2.1e Consolidate ditches	Irrigation Water Conveyance (430)
			2.1f Employ sprinkler system	Sprinkler Irrigation System (440-B)
			2.1g Use gated water pipe	Irrigation System (440)
	2B. Ditch bank and gully erosion (return flow system)	2.2 Perform reorganization of return system	2.2a Install constrol structures	Structural Measures (580-A)
			2.2b Install pipelines	Pipeline (430-AA-GG)
			2.2c Line ditches	Ditch and Canal Lining (430-A-D)
			2.2d Gradient control checks	Structural Measures (580-A)
			2.2e Consolidate ditches	Irrigation Water Conveyance (430)
	2C. Field sheet and rill erosion	2.3 Limit sediment loss	2.3a Level land	Irrigation Land Leveling (464)
			2.3b Regulate irrigation run to proper length	Irrigation Water Management (449)
			2.3c Apply proper amount of water	Irrigation Water Management (449) Hayland Management (510-B)
			2.3d Manage hay production methods	Irrigation Water Management (449)
			2.3e Manage livestock pasturing methods	Pasture Management (510-A)
			2.3f Reorganize delivery system 1) Employ sprinkler system 2) Use gated pipe	Irrigation Water Conveyance (430) Sprinkler Irrigation System (440-B) Irrigation System (440)
			2.3g Change crop use	Pasture & Hayland Mgmt. (510) Conservation Cropping System (328)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Irrigation (cont.)	2C. Field sheet and rill erosion (cont.)	2.3 Limit sediment loss (cont)	2.3h Employ proper crop rotation program	Conservation Cropping System (328) Pasture and Hayland Management (510)
	2D. Salinity due to seepage and artificially high water table	2.4 Reduce total dissolved solids in irrigation return flow and from land surface to a reasonable amount.	2.4a Line ditches to control seepage	Ditch and Canal Lining (430-A-D)
			2.4b Apply proper amount of water for crops needs	Irrigation Water Mgmt. (449)
			2.4c Consolidate ditches	Irrigation Water Conveyance (430)
Range	3A. Sheet and rill erosion	3.1 Manage range to achieve climax cover and to limit sediment loss	3.1a Reduce grazing intensity	Planned Grazing System (556) Deferred Grazing (352)
			3.1b Rest range and rotate grazing	Deferred Grazing (352) Planned Grazing System (556)
			3.1c Achieve uniform grazing intensity	
			1) Construct fence	Fencing (382)
			2) Properly locate livestock water supply	Pipeline (516) Well (642) Pond (378) Tank (614) Spring Development (574)
			3.1d Retain sediment	
			1) Employ pits	Debris Basin (350)
			2) Construct contour ditches	Dike (356) Diversion (362)
			3.1e Retard runoff	Dike (356) Diversion (362)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Range (cont.)	3B. Gully erosion	3.2 Provide a grassed waterway that will carry runoff water without causing erosion	3.2a Reduce water runoff 1) See 3.1a, 3.1b, 3.1c, 3.1d, & 3.1e under Sheet and Rill Erosion	Pond (378-A) Dike (356) Diversion (362) Brush Management (314)
			3.2b Shape waterway and establish vegetative cover	Grassed Waterway or Outlet (412) Vegetative Phase (580-B)
		3.3 Provide a structure(s) to divert runoff through controlled or safe outlet	3.3a Construct sediment retention structures with discharge through proper drop pipe and on safe gradient	Diversion Dam (348)
			3.3b Provide diversion structure	Diversion (362)
			3.3c Construct a series of drops to alter gradient	Diversion (362)
	3C. Wind erosion	3.4 Manage range to achieve climax cover or sufficient cover that high intensity winds will not move soil particles	3.4a Reduce grazing intensity	Planned Grazing System (556) Deferred Grazing (352)
			3.4b Rest range and rotate grazing	Deferred Grazing (352) Planned Grazing System (556)
			3.4c Achieve uniform grazing intensity 1) Construct fence 2) Properly locate livestock water supply	Fencing (382) Pipeline (516) Well (642) Pond (378) Tank (614) Spring Development (574)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Range (cont.)	3C. Wind erosion (cont.)	3.4 Manage range to achieve climax cover or sufficient cover that high intensity winds will not move soil particles (cont)	3.4d Establish vegetative cover	Range Seeding (550)
			3.4e Establish grass, shrub or tree wind breaks	Field Windbreaks (392)
Winter feeding pollution	4A. Organic material, nutrients and coliforms entering receiving waters	4.1 Manage animal waste disposal to limit water pollution	4.1a Relocate feeding grounds	Heavy Use Area Protection (561)
			4.1b Fence livestock from stream bank area	Fencing (382)
			4.1c Harrow or disc into soil on site	Waste Utilization (633)
			4.1d Develop livestock watering sources away from stream	Pipeline (516) Well (642) Tank (614)
			4.1e Construct artificial windbreak away from stream	Field Windbreaks (392)
	4B. Sediment and erosion along stream bank	4.2 Restrict livestock from stream bank	4.2a Fence livestock from stream bank	Fencing (382)
			4.2b Relocate feed ground	
			1) Construct artificial windbreak	Farmstead and Feedlot Windbreaks (380)
			2) Establish tree windbreak away from stream	Field Windbreaks (392)
			3) Develop alternate livestock watering source	Pipeline (516) Well (642) Pond (378) Tank (614) Spring Development (574)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Dry Cropland	5A. Sheet and rill erosion	5.1 Manage cropland to limit sediment loss	5.1a Reseed problem areas to a permanent vegetative cover	Vegetative Phase (580-B)
			5.1b Crop land continuously	Conservation Cropping System (328)
			5.1c Rotate alfalfa with small grains and summer fallow	Conservation Cropping System (328)
			5.1d Maintain crop residue on surface	
			1) Perform minimum tillage	Minimum Tillage (478)
			2) Perform stubble mulch	Stubble Mulching (344-B)
			5.1e Perform field strip cropping	Stripcropping, field (585-B)
			5.1f Contour field strip cropland	Stripcropping, contour (585-A)
			5.1g Farm on the contour	Stripcropping, contour (585-A)
	5B. Gully erosion	5.2 Provide a grassed waterway that will carry runoff water without causing erosion	5.2a See Sheet and Rill Erosion Conservation Practices	
			5.2b Establish grassed waterways	Grassed Waterway or Outlet (412)
			1) Reseed problem areas	Vegetative Phase (580-B)
	5C. Wind erosion	5.3 Manage cropland to limit the loss of particulate matter by high intensity winds	5.3a See Sheet and Rill Erosion alternative treatments and gully erosion alternative treatments or Dryland	
			5.3b Establish field windbreaks	Field Windbreaks (392)

Table 31, cont.

LAND USE AND PROBLEM SOURCES	PROBLEM	BEST MANAGEMENT PRACTICES	ALTERNATIVE BEST MANAGEMENT TREATMENTS	SCS CONSERVATION PRACTICES (and code number)
Dry Cropland (cont.)	5D. Salinity due to seepage and artificiallly high water table	5.4 Reduce total dissolved solids from water runoff areas to a reasonable amount	5.4a Crop land continuously	Conservation Cropping System (328)
			5.4b Rotate alfalfa with small grains and summer fallow	Conservation Cropping System (328)
			5.4c Change crop use from fallow program to premanent vegetation	Range Seeding (550)

FEEDLOTS AND WINTER FEEDING

The legal definition of a "feedlot" is quite broad and includes about any area that is or can be used to confine animals. For the purposes of this report, the YTAPO has used a "functional" definition of a feedlot -- those areas where animal use is intensive enough to destroy all the grass or other vegetation -- as opposed to the legal definition.

The YTAPO staff was pleasantly surprised to find only two feedlots and one dairy operation that were obvious water quality hazards. The feedlots are on Beaver Creek in Fallon County and on the Mussellshell River in Rosebud County. The dairy operation is along the Yellowstone River in Rosebud County. Most feedlot owners have kept their livestock away from areas where the manure would enter a stream or river during normal rainfall or snowmelt events. By prior agreement with the Conservation Districts, exact sites will not be identified in this report. Action will be taken thru the Conservation Districts to eliminate these water quality hazard areas. If corrective measures are not taken, the problem will be turned over to the Water Quality Bureau.

Recommendations for Best Management Practices for feedlots include:

1. Feedlots should be located away from streams or major drainages.
2. Manure should be scraped and piled as close to the soil surface as possible in the spring on feedlots that are used intermittently. Do not disturb the organic matter soil interface. It should be piled or removed and disposed of in fields.
3. Feedlots located on level surfaces should not contribute fecal coliform or nitrates into major streams.
4. Feedlots on steep slopes may have animal wastes runoff after a major storm. Runoff from feedlots on sloping sites should be intercepted and stored in a lagoon until the wastes can be properly disposed of.
5. Some good management practices for applying animal waste on agricultural land are:
   (a) The animal waste should be disposed of in fields after harvest or in the spring. On sandy soil it may be advantageous to apply late in the fall or early spring to discourage nitrification and leaching of nitrate. On heavy soil, timing is more flexible and manure could be applied early in the fall. Animal waste should be disked or plowed following disposal in fields.
   (b) Apply rate of manure in accordance with the crop requirement for nitrogen.
   (c) When large amounts of manure are used, plant highly productive crop to utilize nitrogen and reduce runoff and leaching
   (d) Do not broadcast on wet land, steep land, frozen or snow covered land, on grass waterways where material may be transported into streams.
   (e) Animal waste material is an asset. Don't let it become a liability.

Many ranchers feed livestock in relatively unconfined areas during the winter. In many cases, these areas are also used for the production of hay during the summer. The use of the area by the livestock is not so intense as to kill the vegetation.

The YTAPO did a quick aerial survey of 504 winter feeding operations and classified them according to their potential for causing the pollution of a steam or river. The results of this survey are presented in Table 32. The large area to be covered, the large number of winter feeding operations, and the abnormally low amount of spring runoff precluded sampling above and below the suspected feeding areas to determine the actual input of wastes to the stream or river. It is quite possible that many of the lower ranked feeding operations would only contribute wastes to a stream or river once out of two or three years due to variations in the amount of spring runoff.

The animal waste produced by the 472,000 cattle raised in Southeastern Montana is nearly 4.7 million pounds on 7.7 million acres. This represents about 0.61 pounds of animal waste per acre on an annual basis. This may be more concentrated during the winter months when animals are confined in smaller areas. Regardless, the impact of wintering cattle on water quality is low. However, continued effort must be made to minimize pollution.

Because feeding areas can be easily altered, it should be relatively easy to correct these deficiencies and encourage conservation practices.

RECOMMENDED BEST MANAGEMENT PRACTICES

Feed directly away from drainways on upper terraces.

Feed livestock in dikes where probability of runoff into streams is small.

Develop wells for wintering livestock and feed away from streams.

Maintain adequate land-to-livestock ratio.

Locate feeder and salt blocks away from streams and water course. Move frequently to avoid creating erodible path.

Pump water from a stream or well to tank.

Maintain good forage production on the land and near streams to retard runoff of animal wastes and utilize nutrients.

Do not overgraze along streams or path of runoff. Always maintain good forage production.

Fencing may be impractical but it may be necessary where animals concentrate for drinking.

Good everyday practices to control water erosion.

Table 32. Aerial Survey of Winter Feeding Practices for all Fields Observed and their Ratings of Potential Contribution of Animal Waste Material Along Creeks and Rivers in Southeastern Montana.

	Drainage	Total Sites	Percentage A	B	C
1	Powder River	97	83	14	3
2	Yellowstone River	22	77	14	9
3	Mizpah	20	75	15	10
4	O'Fallon	4	70	15	15
5	Porcupine	3	67	0	33
6	Little Beaver	9	67	22	11
7	Little Powder	23	57	30	13
8	Armells	11	45	55	0
9	Rosebud	60	45	35	20
10	Pumpkin	30	43	53	4
11	Otter	37	41	43	16
12	Little Missouri River	40	38	44	18
13	Tongue	74	34	51	15
14	Box Elder	15	33	53	14
15	Sarpy	25	28	64	8
16	Tullock	10	20	70	10
	Total Sites	504	271	175	58
	Average Rating %		54	34	12

Explanation of the ratings:

A = Very little chance of runoff from the feeding area carrying wastes to a stream or river.
B = Runoff will transport wastes from the feeding area to a stream or river only during severe storms or snowmelt events.
C = Runoff from the feeding area will carry wastes to a stream or river except during dry years.

DRY-LAND FARMING

The supportive report on agriculture provides information on management practices for dry-land farming, including detailed recommendations regarding strip width, amount of crop residue remaining, etc. to control wind and water erosion. A sample of this information is reproduced in Table 33.

Best management practices for dry-land farming must be developed for each farm. Generalized practices are listed below. Special consideration must be given to the concepts of utilizing minimum tillage and a flexible cropping system.

A flexible cropping system, consists of cropping each year when moisture is available, or when weeds become a problem. Cropping each year is usually successful in areas that have 15 inches or more annual precipitation. It can be successful in areas of 13 and 14 inches of annual precipitation when the soil is distinctly moist down to 24 inches in deep sandy loam and 18 inches in deep loam, silt loam, silty clay loam, silty clay and clay at seeding time in the spring. Seeding can be done in the fall if the top 12 inches is moist. Advantages to consider:

a) Less erosion problems.
b) Less time and expense involved because summer fallow tillage operation is avoided.
c) Increased yield as the yield in two years will likely be greater than the yield of one year under a two year cropping system of winter wheat fallow.

The disadvantages of continuous cropping are:

a) Harvesting and seeding every year.
b) Probable increased weed problems.
c) Possible crop failure.

The use of minimum tillage or spring plowing can reduce erosion and decrease fuel costs.

Justification for fall plowing:

a) Clay soils very cloddy and needing the winter moisture to break it down.
b) Winter wheat stubble infested in the fall with "cheat" grass.
c) To prevent wheat streak mosaic in volunteer winter wheat from hail.
d) Crop residue 6,000 pounds and more per acre.

Advantages of spring plowing:

a) Standing stubble will conserve as much of 70% of the fall and winter precipitation. Each inch of soil moisture could increase production 3.5 Bu. per acre.
b) Plan tillage operation to meet crop residue requirements.
c) Comply with energy conservation practices.

BEST MANAGEMENT PRACTICES

Production methods and cultural practices can control pollution resulting from erosion and saline seep. The proper "best management practice" will vary slightly with each field, but the following practices can be utilized in most cases:

1. Leave native sod in the bottom of all drainages or, if necessary, plant "grassed waterways" in existing fields.
2. Keep tillage to a minimum to help maintain soil moisture. Crop residue will prevent wind and water erosion.
3. Develop a flexible cropping system. When soil moisture is adequate, crop every year instead of summer fallowing.
4. Seriously consider the alternatives prior to breaking rangeland for crop production. If you anticipate converting rangeland to cropland, consult the Soil Conservation Service in advance about developing a "farm plan" for land. Follow the plan.
5. Leave a "buffer strip" along all live streams and reservoirs.
6. If economically feasible, construct "check dams" in existing gullies and revegetate the bottoms of the gullies.

Table 33 Non Irrigated Cropland - Comparison of Cultural Practices on Potential Soil Loss by Wind and Water Erosion (continued)

Soil Series and Phase	Dry.	Irr.	Winter Wheat Production: High Level Mngmt. bu/a	Winter Wheat Production: Potential Yield bu/a	WEG	Potential Soil Loss by Wind: Tolerable Loss T/a/yr	Minimum Practice T/a/yr	Current Practices: Strip Width Rods	Current Practices: Residue lbs/a	Current Practices: Soil Loss Unridged T/a/yr	Current Practices: Soil Loss Ridged T/a/yr	Desired Practices: Strip Width Rods	Desired Practices: Residue lbs/a	Desired Practices: Soil Loss Unridged T/a/yr	Desired Practices: Soil Loss Ridged T/a/yr	Frequency of Tillage Operation	Water Erosion Hazard	Potential Soil Loss by Water: Current Practices 300 lbs. Residue Up and Down Hill Tillage T/a/yr	Potential Soil Loss by Water: Desired Practices 700 lbs. Residue Up and Down Hill Tillage T/a/yr	Potential Soil Loss by Water: Desired Practices 700 lbs. Residue Contour Tillage T/a/yr
Shambo Loam, 8-15% slopes	IIIs	--	34	48	5	5	39	30	300	21	7.0	20	1050	5	1	#3	Moderate	3.00	2.00	1.00
Sorum Fine Sandy Loam, 1-8% slopes	IVs	--	18	30	3	5	60	10	300	29	9.5	10	1250	5	1	1a	Moderate	1.90	1.20	0.82
Straw Loam, 0-2% slopes	IIIe	--	45	58	6	5	34	20	300	15	3.5	20	875	5	1	4b	--	0.46	0.31	0.15
Tally Fine Sandy Loam, 2-8% slopes	IIIe	--	32	50	3	5	80	10	300	29	9.5	10	1250	5	1	#2	Moderate	1.90	1.25	0.82
Tally Fine Sandy Loam, 8-15% slopes	VIe	-	26	46	3	5	80	10	300	29	9.5	10	1250	5	1	#2	Moderate	1.90	1.25	0.82
Tanna Silty Clay Loam, 2-8% slopes	IIIe	--	32	38	8	2	34	20	300	15	3.5	20	875	5	1	2b	Moderate	3.46	2.31	1.18
Tarry Fine Sandy Loam, 2-8% slopes	IIIe	--	20	36	3	2	60	10	300	29	9.5	10	1250	5	1	1a	Moderate	1.90	1.25	0.82
Thebo Clay, 2-8% slopes	IVe	--	25	34	4	2	60	20	300	36	11.0	20	1375	5	1	#2	Moderate	3.46	2.31	1.18
Treasure Fine Sandy Loam, 2-8% slopes	IIIe	--	24	38	3	5	60	10	300	29	9.5	10	1250	5	1	1a	Slight	1.67	1.25	0.83
Trembles Fine Sandy Loam, 0-2% slopes	IIIe	IIs	32	50	3	6	60	20	300	38	11.0	10	1250	5	1	#2	Slight	0.33	0.22	0.11
Twin Creek Loam, 2-8% slopes	IIIe	--	40	52	8	6	39	30	300	21	7.0	20	1050	5	1	#3	Moderate	2.62	1.75	0.88
Twin Creek Loam, 8-15% slopes	IVs	--	38	48	5	5	39	30	300	21	7.0	20	1050	5	1	#3	Severe	--	--	--
1			2	3		4	5		6	7	8		9			10				

1. Name for the soil used by the SCS.
2. Wheat yield from farms utilizing good management practices.
3. How much wheat the soil should produce if moisture and nutrients are adequate.
4. Maximum amount of soil that can be lost without affecting crop production.
5. Soil loss during fallow cropping with no residue left on the surface.
6. Pounds of straw and other residue remaining on each acre.
7. Unridged implies a relatively smooth soil surface.
8. Ridged implies a rough surface, as from a duckfoot cultivator.
9. Amount of residue required to keep erosion within acceptable levels.
10. Maximum tillage that can take place without reducing the amount of residue too much.

    1a - shovel, shovel, rod weeder. seed
    2 - shovel, shovel, shovel, shovel trod, seed
    3 - disc, shovel, shovel, shovel, seed
    4b - disc, shovel & springtooth, shovel & springtooth, shovel & spring tooth, rod seed

IRRIGATED CROPLANDS

The supportive report on agriculture provides information on management practices for irrigated cropland, including a series of case studies designed to illustrate the impacts of various management techniques.

Data collected from the Yellowstone-Tongue APO project area and information from reports by experiment stations indicate that inefficient irrigation practices are expensive to the land owner.

1. Canals constructed on salty soils can increase the salt content of the irrigation water. The geology and soils of an area should be evaluated before constructing irrigation facilities.

2. Irrigation on certain geologic formations will cause the return flow and seepage from the irrigated area to be high in salt.

3. Sediment loss in the area averaged; 1700 lb/acre for small grains, 4,035 lb/acre for corn, 2,750 lb/acre for wheat, 11,600 lb/acre for beans, and 65/acre for hay.

   a) Total sediment loss from irrigated fields 90,700 tons/year.
   b) Corn fields contributed 53% of this amount.
   c) The low per acre sediment yield from hay fields and pasture, comprising 51% of the irrigated area, accounts for the low overall sediment yield.

4. Sediment loss varied from 0 to 52,000 lb/acre per year from one field to another. Assuming a loss of 26 tons/acre per year (0.15 inches of soil), the potential economic loss over 40 years due to loss of soil nutrients is as follows:

   a) The annual nitrogen release from the organic matter in 0.15 inches of soil is 30 pounds. Over 40 years, the lost soil would have produced 1,560 pounds of nitrogen. At 20¢ per pound, this is $312 per acre.

   b) The phosphorus lost if the top 12 inches of soil is eroded is difficult to estimate.

5. The loss of nitrogen from fields is dependent upon the amount and time of fertilizer application. It will be approximately 3 lb/acre per irrigation for corn and 15 lb/acre per irrigation for wheat.

6. Fields that are fertilized at high rates and also irrigated with an excess of water will lose large quantities of nitrogen to the soil below the roots of the crop. Some field measurements indicated that the soil from 5 to 10 feet down sometimes contains 400 to 500 pounds of nitrogen per acre. This is $80 to $100 of nitrogen per acre that the crop cannot utilize.

Best Management Practices for irrigated croplands must be developed for each type of irrigated area. There are major variations between the practices used with flood irrigation along the Powder River and those for sprinkler irrigation along the Yellowstone River. A few generalized management practices are listed below.

1. Balance the rates of fertilizer application and water use to prevent the loss of large amounts of nitrogen to the groundwater.

2. If soil salinity is not a problem, use only the amount of water the crop requires. Do not skimp on water during the critical part of the growing season.

3. Try to control the rate of water application if flood or row irrigating so the lower part of the field does not receive an excess or too little water.

4. If the irrigation water is high in salinity, an excess of water must be applied periodically to leach the salts below the roots of the crop.

Salinity problems will increase with the development of additional acreages of irrigated land. The water returning to the streams or rivers from an irrigated area will have an elevated salinity level. This impact can not be avoided, but certain management practices can be utilized to minimize the problems.

Two sources of salinity must be recognized when working with irrigation projects within the YTAPO area.

1. The evapotranspiration of water concentrates the amount of salts to be transported by the remaining water.

2. Certain geologic formations are naturally high in salts and any water moving through this material will increase in salinity.

The first type of salinity source can be partially controlled by lining ditches and controlling water application rates. The guiding criteria should be to MINIMIZE ANY UNNECESSARY EVAPORATIVE LOSSES OF THE IRRIGATION WATER.

The second type of salinity source can be controlled by not allowing irrigation water to leach the salts out on marine geologic formations. THE EXPANSION OF IRRIGATION ON GEOLOGIC FORMATIONS CONTAINING HIGH NATURAL SALT LEVELS SHOULD BE RESTRICTED. State or federal funds should not be utilized to fund irrigation projects in such areas.

While the YTAPO is primarily concerned about water quality, the impact of salinity and sodium upon the productivity of the soils can not be overlooked. The use of high salinity water for sprinkler irrigation will decrease the productivity of the soil unless special management practices are followed. The levels of sodium found in much of the

groundwater within the YTAPO area are high enough to modify the structure of the soil and cause "hardpan" to form. As a result, the YTAPO is issuing two cautions for irrigators:

1. Be very cautious about utilizing wells for irrigation. Most wells in the project area have a high sodium content which will adversely affect the soil.

2. Be very cautious about utilizing anything other than the Yellowstone or Tongue River as a source of water for a sprinkler system. Wells usually have low water yields and the water is normally high in sodium. Other rivers and streams usually have water high in salinity and sediment. Salinity problems are usually compounded when sprinklers are used. Quite often sprinklers are installed on soil with a moderate or high clay content. In addition, the owner often does not anticipate the need for applying excess water periodically to leach accumulated salts below the rooting zone.

As irrigation is the largest beneficial use of water diverted from the streams within the project area, the YTAPO is in the process of attempting to relate the quality of water required for irrigation to the nondegradation concept mentioned in the chapter on water quality. Two studies done for the YTAPO relating to irrigation and salinity are summarized in the"Nondegradation of Water Quality" section on Page 79.

RANGE MANAGEMENT

The supportive agricultural report contains much material on range management practices. As with the other management practices, range management practices must be adopted to the specific parcel of land that is being considered.

A guide to Best Management Practices has been developed to be utilized in conjunction with soil survey data from on-site investigations. A portion of it is reproduced in Table 34. The numbers in the last three columns relate to the management practices described below. The complete set of soils related data is in the supportive report.

MECHANICAL PRACTICES to increase forage production.

1) Contour practices are made by a moldboard plow or some similar implement. Widths and depths of the furrow vary as does the distance between furrows. Ranges in good and excellent conditions seldom benefit from this practice.

2) Pitting is done with an offset disc and makes water-holding depressions. Range is left in an exceedingly rough condition. Poor and fair ranges may be improved by pitting if a few of the higher producing grasses are present. On ranges with a high percentage of blue grasses and other short sod grasses, pitting reduces these grasses and allows the taller grasses to increase.

3) Chiseling is done with a sweep-type implement. It may eliminate club moss and greatly reduce the shallow rooted, less-productive shortgrasses. With deferment, the tall productive grasses are given a chance to increase.

4) Brush control by mechanical means includes roto-beating, mowing, and hand grubbing. Costs are high but vegetative growth may be added to the soil.

5) Water spreading on range by construction of diversion ditches and dikes greatly increases grass production. Costs may be so high for construction that the cost-return ratio would be out of line. With land prices high and beef prices low, the benefits would not pay for themselves for many years.

VEGETATIVE PRACTICES to increase forage production:

1) Range seeding using native adapted species. These fit in with the grazing pattern in a pasture.

2) Pasture seeding using special adapted species should be seeded to fit in with the ranch operations.

3) Fertilization of range has been tried on many range areas with varying results depending on soils, moisture, and plant species present. Only on the deep soils with good moisture-holding capacity and range in good condition will the increased forage pay for the fertilizer.

4) Brush contol by spraying, either aerial or by ground sprayer, gives excellent control of big sagebrush.

MANAGEMENT PRACTICES to increase or maintain forage:

1) Grazing rangeland at an intensity which will maintain adequate cover for soil protection and maintain or improve the quantity and quality of desirable vegetation.

2) Grazing systems on rangeland are usually simple. The rotation-deferment system is where pastures are periodically rested during the growing season within a rotation of several years. Deferred grazing may be used as a system of grazing if plans are made to rest each pasture during the growing season over a period of years. A rest rotation system has advantages on depleted ranges where vigor is low and seed production is needed.

3) Fencing of a range site, especially overflow, is necessary to get good distribution of a pasture. Where overflow sites are within a large pasture livestock overgraze the overflow site and will not properly utilize the drier portions of the range. Frequently, steep and hilly ranges need to be fenced separately from the flatter landscapes.

Several "common sense" management practices apply to rangeland management. They include:

1. Adjust the number of livestock to the carrying capacity of the pasture.

2. Use a grazing system that best utilizes the various types of range available.

3. Maintain a reserve of hay for critical periods of dry weather or deep snow.

4. Provide several watering sites and salt boxes. Move the salt boxes periodically and keep out of stream bottoms.

Table 34. Range Management Practices

Soil Series	Yield (air dried) Normal years	Yield (air dried) Dry years	Practices Mechanical	Practices Vegetative	Practices Management
	lbs/ac	lbs/ac			
Shambo loam, 0-2% slopes	2200	1800	1,2,3	1,2,3	1,2
Shambo loam, 2-8% slopes	2200	1800	1,2,3	1,2,3	1,3
Sorum fine sandy loam, 2-8% slopes	1400	900	1	1,2,3	1,2
Straw loam, 0-2% slopes	2300	1900	1,2,3	1,2,3	1,2
Tally fine sandy loam, 2-8% slopes	2300	1900	1	1	1,2

BASIC RECOMMENDATIONS FOR AGRICULTURE

The Conservation Districts have indicated a desire to assume the responsibility for the sediment and salinity related portions of the Water Quality Management Plan. The YTAPO requested that an attorney review the capabilities of the Conservation Districts and recommend alternative courses of action that might be open to the Districts. A portion of his comments follows:

"First, of course, the districts might reconsider their aversion to following in the footsteps of the Lewis and Clark Conservation District and attempt to enact land use regulations pursuant to the statuatory procedures. This would validate the method of processing violations or non-compliance and would further provide a mechanism for the districts themselves to enforce such regulations in district court.

Still another approach might be taken. Section 69-4809.2(2), R.C.M 1947 states (in part):

> *'The authorized representative of the department [the Department of Health and Environmental Sciences], upon presentation of his credentials, may at reasonable times enter upon any public or or private property to....investigate conditions relating to pollution of state waters...'*

The implications of this section lead me to the belief that it would be possible for the conservation districts in the area to become authorized representatives of DHES for the purposes of investigating conditions relating to water pollution. The districts, of course, would narrowly construe their investigative powers to relate exclusively to the set of standards which they develop and promulgate. The districts might enter into an 'inter-local agreement' between themselves and DHES for the purpose of: 1) providing de facto field personnel for DHES for the purposes of insuring that the standards promulgated by the districts are indeed complied with; and 2) to provide a procedure for dealing with violations of the standards. In this respect, the Department has many times enunciated its goal of voluntary compliance with the water pollution control law. Therefore, it would be harmonious with this purpose for the districts to use every effort to achieve voluntary compliance with the standards.

However, should an occupier of the land within the district be recalcitrant to the point where the district desired to pursue further action, it would be able to process complaints to DHES for enforcement under Section 69-4820 through 69-4825, R.C.M 1947. (See also Section 69-4826, R.C.M 1947) Reports of violations coming from the districts would deserve (and probably receive) most serious consideration by the Department by virtue of the inter-local agreement between the districts and the Department and by virtue of the fact that the districts would be acting as authorized representatives of the Department".

Based on the attorney's comments and conversations with individuals belonging to the Conservation Districts, it appears that the second recommendation is currently the better alternative. This would allow the Districts to attempt to obtain voluntary corrective action to any practices which would adversely impact water quality. It does not obligate the District to be the actual enforcement agency -- something the Districts are very reluctant to handle. A major disadvantage to the alternative is that it is primarily a clean-up approach as compared to a preventive approach.

The Montana Association of Conservation Districts has been reluctant to support the involvement of the local Districts in implementation of the sediment and salinity portions of the water quality management plan. The Association is waiting for the results of the water quality management planning in other parts of the state and apparently desires to support a uniform, state-wide erosion control program. As a temporary measure, a nonregulatory program with the present social and political constraints may be the best action. Implementing a regulatory program at this time would be too expensive unless done on a state-wide level. Local problems appear too great for a local regulatory program.

The YTAPO recommends that the Montana Association of Conservation Districts assist the local Conservation Districts in establishing a cooperative erosion and salinity control program with the Water Quality Bureau. This type of program would allow the Districts to attempt to obtain voluntary correction of water quality problems, but would not put the District in the role of an enforcer.

The Association could utilize their experience with the first year of working with the Districts in the YTAPO area to assist them in evaluating the alternative to be set up on a permanent basis. These alternatives might include:

1. Use of cooperative agreements between the Conservation Districts and the Water Quality Bureau.

2. Establishment of county-by-county programs based on a sediment control ordinance like that passed in Lewis and Clark County.

3. Enactment of a uniform state-wide erosion control act similar to those passed.

4. Allow the Water Quality Bureau or other agency to accept full responsibility for erosion and salinity control programs.

The Districts should also assume responsibility for the implementation of the sediment control program for nonagricultural lands.

Some of the guidelines sent to the YTAPO by the U. S. Environmental Protection Agency used the term silviculture, which relates to the growing of trees for timber production. The YTAPO has interpreted this area much more broadly. The forest resources include forage for livestock, wildlife, recreation, as well as timber.

Proper range management is perhaps as critical to the long-term productivity of the forests within the YTAPO area as is proper forest management.

The supportive report on forestry provides the details of the alternatives that were considered in developing this report. They included the following:

I. No commercial timber harvesting. Limit timber cutting to that consumed on a local basis.

II. Continue commercial timber harvesting.

The second alternative was further divided into three subcategories:

A. Continue without any change.

B. Limited regulation of forestry practices.

C. Rather complete regulation of forest practices. (This would require the enactment of a state forest practices act.)

Alternative IIB. was selected for additional attention. Essentially, existing U. S. Forest Service practices would comply with most of the guidelines anticipated under this alternative. Examples of recommended management practices include:

1. Leave buffer strips of vegetation along streams. Do not log across streams. Avoid felling trees into streams, or leaving organic debris (limbs, tops, etc.) in streams.

2. Time logging activities to prevent excessive soil damage. Do not skid trees through streams or bodies of water. Whenever possible, suspend the head end of the log to minimize soil gouging. Avoid across-ridge or across-drainage skidding.

3. Do not yard through streams or down drainages. Avoid depositing debris (slabs, edging, sawdust and branches, etc.) in streams (drainages) or flood plains. Do not allow oil or fuel to spill in such a location that it will enter any stream. Do not deposit garbage in streams or flood plains.

4. Remove all machinery debris (discarded cable, discarded filters, broken parts, etc.) from any logging site.

5. If any organic or inorganic debris should enter any stream or body of water, remove it as best possible.

6. An unburned buffer zone should be left between slash burns. Burns should be timed to minimize impact on water bodies or runoff.

Due to the relatively scattered nature of the forests on private lands within the YTAPO area, the passage of a state forest practices act was not considered to be a necessary part of this alternative. However, the YTAPO recognizes that other parts of the state may be in need of more restrictive forest practice guidelines. The YTAPO anticipates that the erosion and other water quality control guidelines established by the Conservation Districts and the Water Quality Bureau should be adequate to control private forestry activities.

An area related to forest activities in general, though often funded by timber harvesting, is access roads. This is an area where there may be some conflict between the YTAPO's recommendations and the current activities of state and federal agencies as well as with the practices occurring on private land. Best management practices must be tailored to the site, but they will probably include the following:

1. Build the minimum size and number of roads required to provide proper access.

2. Locate roads on natural benches, ridge tops, flatter slopes, etc. Fit location to topography to reduce alterations of natural conditions. Avoid locating roads on flood plains whenever possible.

3. Avoid steep draws or slopes, erodible soils, springs and seeps, slumps or other hazard areas.

4. When alternative locations are not possible, incorporate corrective actions to reduce sedimentation/pollution.

5. Minimize the number of stream (drainage) crossings. Pick locations requiring a minimum of bank disturbance. Cross streams (drainages) at right angles unless contouring down to the stream bed will result in potentially less bank erosion. Keep machine activity in the stream bed to absolute minimum. Avoid depositing excess material, including debris, in streams (drainages). Prevent road drainage from entering streams.

6. Do not permit earth moving activities when soils are saturated. Road construction should shut down during periods of heavy rainfall.

7. Disturb roadside vegetation only the necessary width to maintain slope stability and serve traffic needs.

8. Outslope roads wherever possible to disperse surface runoff. Avoid concentrating road drainages in draws or on slump areas. Avoid long sustained grades. Design ditches, waterbars, etc. to disperse road drainage wherever necessary. (Field observations have noted improperly constructed waterbars, etc.)

9. Do not oil or chemically treat roads for dust abatement. Do not dump waste oil on roads or in streams. Avoid fuel or oil spills. (This recommendation may conflict with dust control guidelines.)

10. If roads are to be usedmore than one year, install or maintain erosion control features for seasons of non-use. Prohibit unauthorized vehicle traffic which may cause increased erosion.

11. When roads are of no further use, grade and revegetate the surface with appropriate species. Mulch if necessary. Total reclamation may be appropriate for some roads.

12. Balance cuts and fills to provide a minimum amount of disturbance, erosion and/or water turbidity. Compact fill to avoid loss of fill material.
    Revegetate (mulch if necessary) cuts and fills to minimize erosion. Design drainage ditches, waterbars, culvert placement etc. in such a manner as to disperse runoff and minimize cut and fill erosion.

13. Avoid excavation of stream beds during culvert placement, and align culvert with flow. Periodically remove debris from and upstream of culverts. Provide erosion control (riprap, mitered inlets, etc.) at inlets and outlets of culverts where necessary.

14. Restrict off-the-road travel and the use of unimproved trails during wet weather.

Access roads are quite often the major source of sediment when timber harvesting takes place. If not properly cared for, they will continue to erode for many years. Roads that are not required for access for other purposes, such as to grazing leases, should be reclaimed.

In spite of a large number of poorly maintained trails and roads on both public and private land, the impact of the erosion appears to be difficult to isolate. In most cases, the relatively low rainfall and the distance of most trails and roads from perennial streams minimizes effects of sediment from such activities.

NONPOINT SOURCE -- MINING (COAL)

A major factor in the establishment of the YTAPO was the high probability of expanded coal mining and conversion within the project area. The expansion of coal mining is not progressing as rapidly as anticipated by many people. Only a few people present at the YTAPO's public meetings expressed an interest in the direct impact of coal mining on surface water quality. There appeared to be slightly more interest in the probable impact of mining on groundwater quality, which will be treated later in this chapter.

Most professionals contacted by the YTAPO agreed that the State of Montana has the best surface mining law in the western USA and also probably has the best enforcement program. But, some residents of the areas being mined have complained about a lack of strict enforcement of the laws currently on the books.

Due to the high percentage of coal associated with federal surface or mineral rights ownership, the recently passed federal legislation will effectively control most future mining activities. With a few exceptions, the Montana Strip and Underground Mine Reclamation Act and the related regulations developed by the Department of State Lands are already as strict as the new federal legislation.

BEST MANAGEMENT PRACTICES

The YTAPO is proposing that a modified version of the rules and regulations (Montana Administrative Code, 26-48.2 to 26-48.38) developed by the Department of State Lands pursuant to the Montana Strip and Underground Mine Reclamation Act be utilized as the best management practices for the surface mining of coal.

The text of these rules and regulations are contained in the supportive report on mining. Only modifications and other comments are reproduced here.

1. Modifications under the section of prospecting.

   A. Delete portions of sections 6.c. and 6.e. and substitute the following:

      Portable "mud pits"shall be used and excess drill cuttings shall be spread over the surrounding area in a layer thin enough to allow the vegetation to grow. Cuttings from formations that may be toxic to vegetation shall be disposed of in a landfill. No cuttings shall be returned to the drill hole except to fill in that portion of the hole above the upper plug.

1. A. continued,.

All exploratory holes intercepting water of more than 20 feet deep shall be plugged with a beneficiated bentonite mixture, from the bottom up. If an aquifer is penetrated which is under adequate pressure to cause the water to flow to the surface or if a loss of circulation is encountered with the beneficiated bentonite mixture, the hole shall be plugged with concrete from bottom to top.

B. A section 6.f. has been added:

Sediment control structures shall be placed wherever the surface disturbance has been great enough to accelerate erosion.

2. Modification of the section of preplanning.

A. Section C has been added:

After the above data has been collected, the best available techniques shall be used to predict the changes in salinity of the groundwater and the nearby surface water resulting from the operation.

3. Modification of the section on Planting and Revegetation.

A. Rewording of part of sentence 13 to read as follows:

"...a period of ten years AFTER the last application of seed, fertilizer, root stock, etc."

In addition to the specific changes outlined above, the YTAPO recommends that certain factors which may impact water quality, but which are not readily addressed under generalized management practices, should be considered and implemented where possible. These topics of concern are outlined below:

AREAS OF CONCERN

A. Insufficient baseline data. The collection of water quality data for one or two years prior to mining is not adequate. The quantity and quality of the surface water in Southeastern Montana is extremely variable.

B. Lack of capability to predict the cumulative impact of future mines on the groundwater and surface water systems, in relation to both quantity and quality.

C. Measurements and models of pre-mining and post-mining rates of erosion are questionable. Unusually high rates of erosion may result from occasional high intensity storms.

D. Simple, effective criteria have not been developed for the design of stable drainage channels.

E. Professionals still have not reached an agreement on desirability of selectively placing spoils for purposes of aquifer re-establishment or for isolation from future groundwater system, etc.

F. Pressure to allow farm crops to be used as an alternative to the establishment of native species.

   1. Probable lack of adequate cover to keep erosion at acceptable levels.
   2. Possibility of use of irrigation, including the application of excess water to leach salts, which would affect the groundwater system.

NEEDS NOT COVERED

A. Need for monitoring after the reclamation bond has been released.

B. The impact of roads and railroads off the actual mine site.

   1. Current interpretation of Montana's Strip and Underground Mine Reclamation Act is that it does not cover right-of-way work outside the designated mine area.
   2. Railroads appear to be relatively immune from most existing regulations related to erosion control, siting of facilities, etc. It is even possible to construct lines in excess of 20 miles and avoid an EIS procedure by designating the line as a spur line instead of a main line.

C. The siting and control of facilities accessory to mining, including housing and commercial outlets, are under little control.

   1. Current interpretation of state law apparently makes them exempt from county zoning.
   2. Company mobile home courts can be set up in such a way as to be exempt from the laws governing mobile home courts.

ANTICIPATED PROBLEMS

A. Local groundwater systems will be destroyed.

B. Mines intercepting certain groundwater systems, as along the Tongue River, may cause a slow increase in the dissolved

solids concentration of surface waters, including an increase in the proportion of magnesium and possibly other ions.

C. Increased runoff and resulting erosion may alter some existing stream channels.

D. The overgrazing of land that is anticipated to be mined may make pre-mining erosion and groundcover measurements erroneous.

CAPABILITIES REQUIRED IN THE FUTURE

A. Application of predictive tools to the impact of mining on groundwater.

B. Quantification of the cumulative effects of mining on surface and groundwater systems.

C. Extension of runoff and water quality records by correlation with climatic events. (This capability is already available relative to the extension of runoff records in temperate climates, but our recent experience indicates that there are no reliable techniques for the extension of runoff records in the semi-arid plains.)

D. Selection of a few representative sites for intensive, continued water quality sampling and development of a method for extending these records to other sites. (Areal as opposed to empirical extension mentioned under item C.)

E. Prediction of impacts on future groundwater systems due to selective placement of spoils.

POSSIBLE FUTURE MODIFICATIONS

A. Assuming political pressure will cause the creation of an option for reclamation to agricultural uses and require the construction and continued maintenance of runoff control structures designed for long term (50 yr.) usefulness. Also, it will require the reclamation bond be retained for a minimum of 10 years when reclamation involves a type of groundcover not capable of natural propagation.

B. Assuming mining will disrupt certain groundwater systems, develop a procedure to predict the impacts on groundwater and surface water and also incorporate a system for reimbursement of the affected parties into the application for the mining permit.

NONPOINT SOURCE -- MINING (NON-COAL)

The non-coal mining activities are primarily related to the extraction of bentonite and gravel. Scoria is mined as a substitute for gravel and occasionally a limited amount of "hard rock" mining takes place near the Yellowstone River to produce materials for rip-rap.

Solution mining for uranium may occur in Carter County in the next few years. This topic is treated later in this chapter under Groundwater.

Mining for clay (bentonite), sand and gravel is covered under the State's "Open Cut Mining Act." This act requires the development of a mining and reclamation plan prior to the initiation of mining. A bond of up to $1,000.00 per acre helps to assure the erosion control, re-vegetation, etc. practices outlined in the mining plan are implemented.

The "Hardrock Law" includes similar planning and reclamation provisions that apply to operations that are extracting rock fill and rip-rap.

BEST MANAGEMENT PRACTICES

The diligent enforcement of the existing regulations should result in the implementation of the proper best management practices for non-coal mining activites.

Off-site activities, specifically the construction and maintenance of roads, may require additional attention. The guidelines provided under the section on forest resources should be utilized.

There is a noticeable overlap between the Best Management Practices for construction activities and those for mining and forest roads. As with these categories, most of the episodes of high sediment yield are related to intense storm events. The proximity of the project to a stream partly affects the amount of sediment entering that stream or river.

There are essentially three basic measures for controlling the runoff of sediment from construction sites. They include: 1) preventing erosion of exposed soil surfaces, 2) restricting the transport of eroded particles, and 3) trapping sediments being transported. Measures developed for controlling movement of sediment and other materials by water generally are useful also for controlling that generated by wind erosion.

Erosion prevention of exposed soil surfaces is achieved by protecting these surfaces with such covers as mulch, sheets of plastic, fiberglass roving, burlap, rock blankets, or jute netting; temporary growths of fast-growing grasses; or sod blankets. Sheets of plastic and netting materials are generally used on steep slopes where vegetation is difficult to establish or erosion is rapid. Seeding of temporary fast-growing grasses is most desirable when final grading cannot be completed immediately. Sod is often used as a covering in critical areas susceptible to erosion.

Limiting the areal extent of soils disturbed at any one time is a usable mechanism for minimizing erosion. It can be achieved by planning the job so as work progresses, existing vegetation is removed only on that area of soil surface essential to immediate activities. Thus, construction activities are completed on each exposed area and revegetation accomplished as rapidly as feasible.

Solid wastes should be collected at the site and removed for disposal in authorized disposal areas. Frequent garbage removal is essential. Often, borrow pits or excavations can be filled with inert solid wastes. Such pits should be located away from slopes, drainages, and groundwater recharge areas.

Runoff of construction chemicals from paints, cleaning solvents, concrete curing chemicals, and petroleum products can be largely restricted by sediment control measures. Many of these materials are carried by sediment particles. Good "housekeeping" procedures such as proper disposal of empty containers, prompt cleanup of accidental spills, and neutralization of deactivation of excess chemicals and wash waters should minimize runoff of the remaining materials. Holding ponds should be used to collect surface runoff of contaminated waters. Biological pollutants from human sources can best be controlled by installing and maintaining portable toilets at construction sites.

Several general Best Management Practices for the control of sediment from construction activities are listed in Table 35. Additional material is contained in the supportive reports and in the following two sections of this report.

Table 35. General methods to control sediment resulting from construction activities.

Runoff Control Method	Function
Selective grading and shaping	Reduces critical slope lengths and gradients, slows runoff.
Vegetative buffer strips	Reduces runoff velocity, filters sediments from runoff, reduces volume of runoff by increasing surface ponding.
Roughened surface	Reduces velocity, increases infiltration rates, collects sediment, holds water.
Benches	Reduces runoff velocities by decreasing slope length, provides access to slopes for revegetation.
Diversion structures	Collects and directs water from vulnerable areas to prepared drainageways.
Grade control structures	Reduces flow velocity, reduces erosive capability.
Grassed waterways	Filters sediment, slows flow, stabilizes drainageways.
Level speader	Converts channel or pipe flow to sheet flow, increases deposition.

CONSTRUCTION -- SUBDIVISION

Two types of "subdivision" construction activities should be considered -- those covered by the subdivision regulations which undergo a basic review of wastewater disposal systems and those exempt from the regulations or platted prior to the existence of the regulations and not susceptible to review.

The current laws prevent the construction of permanent structures in flood plains, require minimum standards for household wastewater disposal, and require proper disposal techniques for residual solid wastes. Stormwater runoff is addressed, but the provisions do not adequately consider the potential for on-site management of runoff.

Actually there are two laws covering subdivisions:

1. The "Subdivisions and Platting Act" under which the Department of Community Affairs has set up a series of minimum requirements for roads, surface drainage, etc. that are adopted by the counties.

2. The "Sanitation in Subdivisions Law" under which the Department of Health and Environmental Sciences reviews the water supply, wastewater disposal, and solid waste disposal practices proposed for new parcels of land.

Many people have been able to avoid the "Subdivisions and Platting Act" through several exemptions to the act, but virtually all land subdivided for the construction of a home or homes is subject to the "Sanitation In Subdivisions Law". As a result, the installation of wastewater disposal systems in areas of new construction is rather tightly regulated. There has been some confusion due to the overlap between the two regulations. Most people contacted by the YTAPO believed that the process required for the review of new subdivisions should be simplified.

Wastewater systems constructed on parcels of land platted prior to the establishment of the two subdivision laws are not subject to review. The state does not have any general regulations concerning the installation unless it becomes obvious that a public health hazard has been created. Some people have been led to believe that the Bulletin #332, "Septic Tanks", illustrates legal requirements for the installation of wastewater disposal systems. It does not, unless it has been adopted by a local unit of government as part of a local regulation.

The Best Management Practices for subdivisions (and the construction of dwellings and commercial developments in general) being recommended by the YTAPO fall into several categories:

I. Revision of existing household wastewater disposal guidelines used by the state and adoption of basic wastewater disposal ordinances by the counties.

Bulletin #332 currently published by the Department of Health and Environmental Sciences and the Extension Service

is obsolete. Practices such as seepage pits are still recommended while the newer mound systems are not mentioned. The use of 750 gallon septic tanks and a minimum of two feet between the drainfield and the watertable (especially in highly permeable soils) are questionable. The development of a revised publication on household wastewater is necessary. The YTAPO attempted to initiate such a project in 1976 but became bogged down in the details. Such a publication should recognize that there is more than one procedure best able to size a system.

The counties should adopt household wastewater disposal ordinances as soon as possible. Such ordinances may reflect the low density of population of much of the area. For example, they could only provide for on-site inspection of new installations in developed areas. The Health Officer should be able to require the use of septic tank system or a reasonable substitute without having to resort to more general public health regulations.

II. Adoption of more flexible guidelines by the Subdivision Bureau in their review of new projects coming under the existing laws.

The classic septic tank system with a conventional tile field is the only type of household wastewater system normally allowed for new dwellings or commercial developments. An allowance should be made for the use of reasonable alternatives.

III. Modification of some of the exemptions to the Subdivision and Platting Act which currently allow a large percentage of the subdivision developers to find loopholes in the act.

Concurrently with this modification, the review process related to this and the Sanitarian in Subdivisions Law should be streamlined.

IV. The review process should include consideration of the following:

A. Natural geologic and soils problems, including potential for erosion and stability problems and the inclusion of proper preventive measures.

B. The inclusion of recreational livestock (as horses) or "subsistance farming" activities and the impact of such activities on the soils and the runoff from the area.

C. The need for measures to moderate the impact of the development on surface runoff. Will the increase in impervious area increase the peak runoff? Will livestock, vehicles, etc., contribute pollutants that will be transported to natural drainages by the runoff?

D. The means of controlling erosion during the construction of the development. An area should not be graded and left without cover for an extended period of time.

V. The plans for development should be reviewed by the local county planner and planning board with the help of a professional person from the SCS or Conservation District to evaluate the adequacy of the erosion control practices and the potential for soil or water related problems.

CONSTRUCTION -- RIGHT-OF-WAY

Highway, railroad, and transmission line construction will increase as the energy resources in Southeastern Montana are extracted and exported.

The tendency for such activities to take place in relatively sensitive areas (immediately adjacent to river channels in the past) make it especially important that proper erosion control and related water quality management practices are followed. On a short-term basis, more land will be disturbed by these activities than by the act of mining.

A qualitative review of highway projects indicates a major improvement in erosion control practices during recent years. In fact, some of the recent two lane roads appear to have been built with more care, relative to erosion control, than the interstate highways. This is encouraging. But it must be mentioned that an outstanding example of poor erosion control exists on a recently constructed segment of two lane highway immediately adjacent to the Tongue River.

The following are preventive measures which should be considered in future right-of-ways construction:

1. Enforcement of existing ordinances and contract provisions through increased inspection during and after construction. If existing standards for construction activities, both those specified within the contract and those presented in accepted guidelines were met, many problems would be prevented. The Division of the State Highway Department responsible for the enforcement of erosion control, revegetation, etc. is severely handicapped by having only one person to cover the entire state of Montana. This person is additionally handicapped by not having any authority to require the modification of current practices when on the site. He must work through accepted "in-house" channels instead of directly with the people in the field.

2. Restrictive zoning and exclusion of construction of structures within stream environment zones. This would entail enforcement of statutory provisions already in effect.

3. Revegetation of disturbed areas for either temporary or permanent surface protection. This provision is currently required in Montana statutes. To correct problems created by pre-law construction and in the case of contemporary seeding failures, it may be necessary to regrade overly steep cuts or fills and re-seed to a currently approved seed mixture.

4. Inspection and maintenance of areas where work is being performed to modern statutory requirements with corrective measures taken when necessary. It may be necessary to allocate larger portion of bids to prevention, maintenance, and possible corrective measures.

5. Structural control measures may be necessary to solve problems created by past construction practices such as mechanical stabilization and alteration of critically steep slopes.

6. Preconstruction route selection which would cause the least detrimental effect to water quality should be emphasized. Particular attention should be paid to the possible route from Miles City to Decker along the Tongue River. The SCS soil survey and Universal Soil Loss Equation should be utilized in determining erodability of soil types and erosion preventive measures required in a particular area. A major construction project like this would probably be subject to extensive public and governmental review procedures.

7. A review of the listed EIS practices necessary to minimize the impact of the project to determine if these practices had actually been carried out in the field.

While the above comments apply to all types of right-of-way construction, the YTAPO is concerned over the apparent exemption of the railroads from normal guidelines for erosion control, etc. Also, the status of the proposed slurry pipelines relative to existing control measures is not known. Some type of review of proposed railroad construction is necessary to be sure erosion control practices are followed. The local Conservation Districts with professional help from the SCS could be one means of reviewing the railroad's erosion control practices.

NONPOINT SOURCE -- HYDROGRAPHIC MODIFICATIONS

Most activities involving the modification of a stream channel fall under one or more existing state or federal regulations. An exception is the construction of major off-stream storage facilities.

The following list of management practices are recommended to ensure major projects of significant size on all streams within the 208 area are subject to review.

1. Amend current definition of a perennial stream to include those streams having occasional periods without flow.

2. Include the Little Missouri River and Box Elder Creek in Carter County under Conservation District regulations in the Stream Preservation Act.

3. Preconstruction inspections should be performed by engineering personnel when applications are made for major construction under the Stream Preservation Act.

4. Require more construction review of large off-stream reservoirs for impact on water quality and safety considerations.

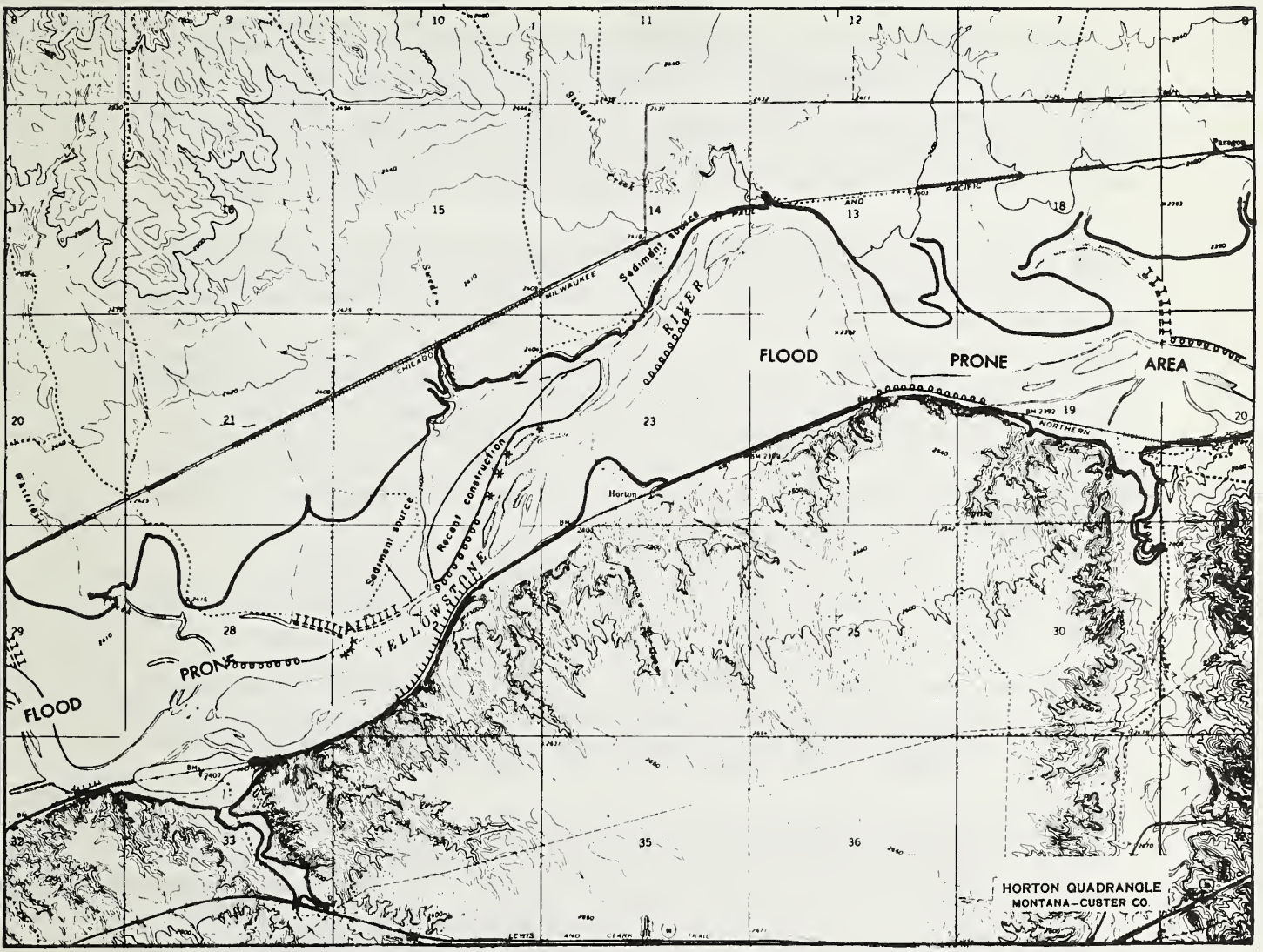
With the exception of 4, all of the recommended management practices could be included under available statutes. Item 4, the construction of off-stream reservoirs, will be included under the Facility Siting Act if the water is used for energy conversion facilities or other related projects. However, off-stream reservoirs which will use the water for agricultural purposes are not covered under any current guidelines. Because of potential hazards of large off-stream reservoirs from a safety and water quality viewpoint, legislation should be enacted requiring a review of any large off-stream reservoir. The review should include an evaluation of water quality impacts of the dam.

The conflicts in the review procedures between the Montana regulations (Senate Bill 310) and the federal regulations (Section 404) concerned with activities within the stream channel should be minimized. The current overlap between the regulations and the associated paper work has caused most people to ignore both regulations whenever possible. Many pump ramps, etc. have been constructed without any attempt to comply with the procedures attached to either regulation. The Corps of Engineers apparently is unable to enforce its program. The Conservation Districts do not appear to be concerned about enforcing the state regulations if the violation does not appear to be having a major impact on the river.

The "Best Management Practices" for hydrographic modifications is to streamline and enforce the existing programs.

The maps in the supportive report (example in Figure 8) delineate the obvious water quality hazards existing along the Yellowstone, Tongue, and Powder Rivers.

Figure 8. Sample copy of maps contained in supportive report on Hydrographic Modifications.



NONPOINT SOURCE -- URBAN RUNOFF

Urban runoff within the Yellowstone-Tongue 208 area is presently not covered by point source permits as required under federal law for larger urban areas. Under Montana's Water Pollution Control Act, permits may be required for any source of pollution including storm drains entering surface water. This provision has not yet been applied to the storm drains of the larger areas within the Yellowstone-Tongue 208 area.

Miles City and Colstrip are the only communities with formal storm drain systems. Colstrip has a recently developed storm system for the main portion of the community and the water is apparently discharged into the sewage disposal system developed for the community (personal communication, Western Energy, February, 1977). Miles City has multiple storm sewage discharges into various drainage basins including the sloughs or drainage-way flowing directly into the Tongue and Yellowstone Rivers. The Montana Department of Health and Environmental Sciences has not yet determined there is sufficient discharge warranting a permit for these storm drain outlets. There is apparently no direct surface discharge from the town of Colstrip to any surface waterways.

The following management plan is recommended for the urban areas within the 208 area in consideration of the extent of the problem as outlined in the descriptive section of this report.

1. Any new community developing a formal storm drain system should be required to use retention basins to ensure storm water contaminants from urban runoff are not deposited into a surface waterway over a short period of time.

2. The storm water system for Miles City should be investigated to determine the financial feasibility of developing retention facilities for the storm drain system. The decision concerning whether or not storm water retention systems are required should be based on: 1) evaluation of actual water quality measurements from the storm drain system after intense storms, 2) the relative impact such water will have on the water quality of the Yellowstone and Tongue Rivers, and 3) the estimated cost for such a system.

3. For any community having a formal storm drain system, it should be illegal to deposit any highly toxic substances, oils, grease, or other deleterious materials into the storm drain system. In addition, maintenance of streets within the community by periodic sweeping would be desirable to reduce pollution loads. For the communities without formal storm drain systems, consideration should be given to their development. The desirability of such systems should be determined by local community members as to the convenience of having improved street drainage versus the cost. The general water quality impact of runoff from urban areas without formal drain systems within the study area appears to be minimal.

4. It should be illegal within all communities of the 208 area to deposit toxic materials into any intermittent drainage-way.

Implementaion of the above recommendations will provide protection of surface waters from urban runoff with minimal expenditure. Data is presently inadequate to determine if any serious water pollution problems occur as a result of urban runoff. Potential problems do exist in the Miles City area and possibly in the vicinity of Forsyth if toxic materials or other harmful substances are deposited into the storm drain system or in drainage-ways.

Alternative methods for management of identified water quality problems may be approached by either structural or nonstructural control methods.

Alternative nonstructural management practices include the following:

a. Tighter restrictions on construction activities and greater enforcement of all ordinances through increased inspection.

b. Enforcement of existing statutes which restrict construction of permanent structures within stream environment zones. Completion of comprehensive plans throughout the APO area with interim zoning to improve water quality.

c. Transfer of development rights from high erosion potential areas to those with low erosion potential.

d. Land purchase of critical environmental areas and transformation to uses which will not degrade water quality.

e. Restoration of natural drainageways and watercouses to be used as integral components of runoff management systems.

f. Revegetation of disturbed areas for either temporary or permanent surface protection.

g. More intensive maintenance routine, altered to reflect increased environmental considerations.

Structural control methods may be necessary to correct some of the pre-law problems or must be incorporated within current and future projects.

a. Mechanical stabilization of oversteepened slopes.

b. Paving streets, secondary routes where highly erosive material is exposed.

c. Local drainage collection systems (curb and gutter, culverts, retention ponds).

d. Major storm drainage systems.

e. Treatment of runoff waters where problems indicated by monitoring have not been affected by maintenance procedures.

Some of the listed alternatives simply do not represent financially feasible solutions to water quality problems in the APO area. In addition to being too costly, several are probably beyond what could be called "politically implementable" alternatives at this time. These alternatives probably include:

Development rights transfer
Creation of zoning or interim zoning
Land purchasing
Restoration of natural drainages
Large scale paving projects

NONPOINT SOURCE -- RESIDUAL WASTE

The low population density and limited precipitation occurring in Southeastern Montana has prevented the classic landfill/leachate problems. Instead, a different problem -- lack of enough waste to finance the operation of a true landfill has dominated the area.

Mine spoils are not considered to be a waste material for the purpose of this discussion. It is assumed that the mine spoils will be placed into the mined area as a reasonable substitute for the original geologic material. The fragmentation of these materials may increase the probability of leaching undesirable solids. This potential problem will be discussed in the section of this report on groundwater.

HOUSEHOLD AND COMMERCIAL WASTES

Much of the estimated 30 tons per day of waste generated in the project area is not disposed of in a properly operated sanitary landfill. Many rural property owners dump their solid wastes in a depression or gully out of sight of the house. Roadside dumps are still being used by some people, including highway crews collecting trash from the roadside barrels.

The state Solid Waste Management Bureau (letter of 4/25/77) provided the following information on the status of the municipal waste disposal areas:

Custer County

Miles City - This site is owned by the city and is operated and maintained by a private contractor. The site location appears to be satisfactory as does the operation and maintenance of the site. There have been times when we have received burning complaints, but in the past few years the disposal methods observed were adequate.

Fallon County

Baker - This site is owned and operated by the City of Baker. Site location appears to be satisfactory. The operation and maintenance practices at the site have been irregular recently. Burning was observed as was inadequate covering. For some reason the operation and maintenance has slipped, inasmuch as past inspections of the site have shown the operation and maintenance to be acceptable.

Plevna - It has been rumored that an old site is still receiving some solid waste. It is our understanding, however, that Plevna residents haul refuse to Baker.

Carter County

Ekalaka - The site is owned and operated by the Town of Ekalaka. Maintenance is infrequent and not acceptable. The site, if operated properly at its inception, would have been satisfactory. However, poor operation and maintenance practices in the past have made proper operation and maintenance difficult and expensive. The town has been advised to properly close the existing site and start fresh at another approved location.

Powder River County

Broadus - It is believed that this site is located on BLM ground and operated by the Town of Broadus. The site is located in a rather deep draw in which dumping occurs approximately one-third of the way down the draw. Thus, there is a potential for surface runoff to enter the dumping area. Past operations and maintenance practices have consisted of dumping and burning with little, if any, covering. It is our understanding that the town has now moved to the top of the draw and is operating and maintaining an approved disposal site. This has not been substantiated by inspection to this date. (YTAPO, August, 1977. Broadus has reclaimed the lower part of the draw and is dumping at a new site.)

Treasure County

Hysham - Ownership of the site is not known, however, the city does operate and maintain it. It might be better to say they try to maintain it. The site is totally used up. There is no cover material available and, as a result, they must burn the dumped refuse. An alternate solid waste disposal program needs to be initiated. They may be involved in the Rosebud County plan which is explained later.

Rosebud County

Forsyth - Land is leased from a private owner and the city is responsible for operation and maintenance. The city is searching for a new site because the lease runs out in June of this year and it appears it will not be extended or renewed. Operation and maintenance practices could be improved to facilitate more effective and efficient covering. However, for the most part, operation and maintenance practices appear satisfactory.

Colstrip - Site is owned by Western Energy and operated and maintained by the Bechtel Power Company. We have had some problems in the past, however, present operation and maintenance practices appear to be satisfactory. Site appears acceptable and is located in old spoil banks north and east of town.

Ashland, Lame Deer, Rosebud - These three disposal sites could all be lumped together and more properly be called open burning dumps. The sites apppear to be acceptable, but operation and maintenance at the sites are nonexistent.

Ingomar - It has been rumored that a disposal site exists in this area. I have not seen the site, but a reliable source indicates that it is also an open burning dump.

The Rosebud County Sanitarian and the County Commissioners are investigating the possibility of establishing a county-wide solid waste program. The existing sites would be closed with the exception of Colstrip and Forsyth. In their place would go large bulk containers (40 cubic yard). If this idea were to materialize, Rosebud County would have an excellent solid waste disposal program. (YTAPO, August, 1977. This program is being established.)

Leachate is not a problem due to the limited amount of precipitation received in the area. Surface runoff due to intense thunderstorms may enter the active disposal area of a few sites, including those at Broadus and Hysham. Open burning is practiced at some of the sites.

The low population density of the area makes it difficult to operate a good sanitary landfill for a reasonable cost. A report by HD&R (1976), "Solid Waste Management Strategy", estimates the area will generate 77,000 lb/day of solid waste by 1980. They calculated $168,000.00 per year would be the minimum cost to dispose of this waste.

The Solid Waste Management Bureau is currently (1977) trying to force the communities to clean up their waste disposal sites by refusing to approve new subdivisions if the solid waste disposal site is not operated properly. This would prevent the expansion of any problems but will not correct any problems due to runoff from intense storms flowing through abandoned disposal sites.

ENERGY CONVERSION WASTES

Two energy conversion facilities are operational within the project area, Colstrip Units 1 and 2 and the Montana-Dakota Utitilites turbine unit at Miles City. The turbine unit will not be treated in detail. Also, since Western Energy has started the construction of Units 3 and 4 at Colstrip, these units will be treated as existing units.

Several coal gasification facilities and a magneto-hydro-dynamics plant have been proposed for the area. The residual wastes from these units will be treated in a general sense.

Colstrip Units 1 to 4

Data contained in the Draft EIS (1974) on Colstrip 3 and 4 and verified by a telephone conversation with Western Energy officials indicates that the four units (1 through 4) will produce approximately 1.2 million tons of ash and 0.2 million tons of scrubber residue per year (dry weight).

The primary concern is relative to the probability of:

1. Accidental or intentional spills of raw chemicals or the ash or sludge.

2. The probability of the "sealed retention ponds" used for disposal of the ash and sludge developing leaks.

Coal Gasification

The data currently available on gasification plants is summarized in the chapter devoted to Energy Conversion. Apparently the residual wastes will include those wastes common to a coal fired power generation plant plus additional ash and high solids condensate from the gasification process. Part of the waste will go to ash dewatering ponds and part of it to evaporation ponds. There is a possibility the gasifier condensate sent to the evaporation ponds might be high in phenols and other organics.

Magneto-Hydro-Dynamics

The best information available to date indicates that the residual waste from a MHD plant will be similar to that from a conventional coal fired generation plant.

MUNICIPAL SLUDGES

Sludges are often generated by municipal sewage treatment plants and water treatment plants. The sewage treatment plant sludge is the biologically degraded residue from the sewage solids. The sludge from the water treatment plants is sediment settled out of the river water with the assistance of alum or other chemicals.

The water treatment plant sediment is being disposed of locally by landfilling.

Ekalaka provides the dried sewage sludge to anyone wishing to use it for a soil conditioner.

Miles City, Forsyth, and Colstrip will be switching from lagoons to oxidation ditches for sewage treatment in 1978. It is anticipated that the sludge will be dried and disposed of in a sanitary landfill.

HAZARDOUS WASTES

The disposal of small amounts of excess pesticides and the empty containers is a problem. The State Solid Waste Bureau attempted to develop a landfill to handle such materials but encountered stiff resistance due to public relations problems.

Heavy metals, toxic organics, and similar compounds are not known to be utilized within the project area in quantities or situations that would cause them to be a solid waste disposal problem.

Radioactive materials are used for well logging and medical purposes. The hospitals dispose of their excess radioactive materials by allowing them to decay for several half-lives and then flushing them into the city sewer system. No attempt is made to separate the residual radioactive materials ingested by patients from the central wastewater system.

NONPOINT SOURCE -- SALT WATER INTRUSION

Classic salt water intrusion, the displacement of freshwater from an aquifer by the intrusion of ocean water in coastal areas, does not occur in Southeastern Motnana. But, the influence of historic oceans on the geology of the area does allow the possibility of saline groundwater from one geologic formation entering another formation containing fresh water and causing a problem similar to coastal salt water intrusion.

The contamination of upper "fresh" aquifers by water from deeper saline formations is not a common problem, but rather a potential problem. The primary Best Management Practices is the plugging of abandoned oil and gas wells.

NONPOINT SOURCES -- GROUNDWATER

Data compiled for the YTAPO by the Montana Bureau of Mines and Geology shows there are approximately 6,000 wells within the project area averaging approximately 225 feet in depth.

Alluvial deposits of sand and gravel along stream valleys are common sources of groundwater. In the Fort Union formation which underlies over one-half of the project area, aquifers comprised of sand and coal beds may produce good quality water. Deeper wells often penetrate the Hell Creek or Fox Hills formations underlying much of the area. These wells may be artesian and usually produce very soft water. At greater depths, about 7,000 feet below the surface, is the Madison limestone formation.

The elected officials directing the efforts of the YTAPO requested the staff put more effort into the investigation of groundwater problems than is usually done by a "208" agency. This directive proved well based on the dominant comment at the public hearings, "... protect the groundwater."

As mentioned in the prior chapter on water quality, it proved difficult to quantatively document occurrences of groundwater contamination. Many qualitative observations were referred to us by well drillers, local ranchers, etc. As a result, the YTAPO proceeded under the assumption that any reasonable preventive practice should be evaluated. The YTAPO also contracted with a groundwater consultant from Colorado to evaluate the probable impact of solution mining and tertiary recovery on the groundwater.

GROUNDWATER -- INTERMIXING

The intermixing of two aquifers can occur due to geologic discontinuities, unplugged exploratory drill holes, improperly sealed wells, or wells with corroded casings.

Contamination due to the intermixing of naturally occurring low quality water with usable water can be prevented by careful drilling techniques and the proper plugging of exploratory holes or sealing of well casings. Local well drillers have reported areas near the coal fields where shallow formations holding low quality water may "leak" into deeper usable aquifers if sloppy drilling techniques are used. The available data was not adequate to map these areas.

The second type of intermixing involves the "leakage" of man-induced contaminants from a relatively confined zone to an aquifer. Specifically, the potential for loss of chemicals utilized for the solution mining of uranium and for the tertiary recovery of petroleum. Again, the proper plugging of exploratory drill holes and abandoned wells and careful sealing of well casings can prevent most problems. In some areas, geologic discontinuities, such as faults, could cause a leakage of fluids but no discontinuities are known in the formations where the solution mining and tertiary recovery techniques are anticipated.

PLUGGING PROCEDURE

The YTAPO met with representatives from several agencies to discuss the type of exploratory hole plugging techniques that should be utilized to prevent groundwater contamination.

The conclusion of the meeting was that a special bentonite mixture should be used to plug all exploratory holes unless a confined aquifer, which was under enough pressure to flow at the surface, was penetrated or the driller lost circulation with the bentonite mixture. In the case of the two exceptions, a cement mixture, properly formulated to stay intact under exposure to the chemical conditions found in the formation, should be utilized to plug the hole.

The recommended plugging procedure is as follows:

1. The New Mexico regulations serve as a basic regulatory model for those to be applied in Montana, but Montana should include additional detailed descriptions of procedures after those outlined by Power Resources.

   The specification of Baroid products should not be made. Rather, the viscosity of the beneficiated bentonite mixture, its gel strength, and its filtrate volume should be emphasized. These should meet or exceed those provided by the Baroid mixture. However, only the viscosity should have to be measured for each hole and should be 20 seconds greater than of the drilling mud. Thus, for mixtures developed by other companies, evidence will have to be produced showing the required viscosity - gel strength - filtrate relationships before they will be acceptable for use. If circulation is lost and a column of mud cannot be maintained, the hole shall be plugged with the cement slurry.

2. Flowing artesion wells should be plugged with a cement slurry of at least 15 pounds per gallon weight.

3. Reports on hole locations, depths, plugging procedure, etc. shall be required. A representative of the state shall be designated and an affidavit shall be filed, as in New Mexico.

4. All holes shall be plugged from the bottom up, except as in #6, below.

5. Seismic holes shall be plugged by running non-metal drill pipe or hose into the hole to point between 15 and 20 feet above the shot depth and then plugged as other holes.

6. Maximum depth of hole exempt from plugging from the bottom up is 30 feet.

7. All holes shall be plugged with cement from approximately two feet below the ground surface to approximately eight feet below the ground surface. A steel or iron marker shall be placed in the hole above the cement plug. No metallic objects, rocks, etc., shall be incorporated into the cement plug.

8. An optional method of ensuring proper hole plugging is a licensing program for exploration drilling contractors similar to that required of water well drilling contractors. This license would put the responsibility of proper plugging on the drilling contractor or other representative who is in the best position to see the plugging is done correctly. The license could require reports to be submitted on plugging and records to be kept by the contractor.

Details of the recommendations are in the supportive report on the "Potential for Groundwater Contamination."

The plugging of exploratory drill holes with the special bentonite mixture is still considered to be experimental by some people. The criteria for plugging may have to be modified after an adequate amount of field data has been collected on the process. As part of its recommendation to use this plugging process, the YTAPO also recommends that several holes plugged in this manner be re-entered to determine the stability of the plugging material over a period of time.

GROUNDWATER -- SOLUTION MINING

Although solution mining of uranium has been conducted during the last several years, its practicality and effectiveness as a mining technique is still in the testing phase. Its relatively small cost compared to underground mining and open pit mining may result in it being a viable mining technique. Consequently, it is wise to plan for the possibility that this technique may be used in Southeastern Montana.

Expertise Requirements

Solution mining does not require particularly difficult techniques. It can be safely conducted if the expertise is available to the operator. Solution mining requires a multi-disciplined approach with experts in hydrology, chemistry, water well construction and completion, groundwater hydrology, and metallurgy. Presently, there are very few groups other than major mining companies and oil companies having such a diverse team available to successfully accomplish solution mining. Even the major firms use consultants in some fields to complete the team. Consequently, to ensure that knowledgeable people are conducting solution mining, the state should include a system to evaluate the expertise of solution mining companies.

Hydrogeologic Studies

In order to protect the state's groundwater resources, consideration should be given to establishing rules and regulations within the existing framework of state agencies to require a permit for solution mining. This permit should be issued only after careful investigation.

Submitted with the permit application should be a description of the mining process and a plan for aquifer reclamation. The study should include a determination of the groundwater gradient for each aquifer above the solution mining interval and for the shallowest aquifer underlying the interval. The study should also include an evaluation of porosity, permeability, storage coefficient or specific yield, direction of and rate of groundwater migration, and the extent of aquifers in the area. The extent and hydrologic characteristics of confining strata need to be determined.

Included in the report on the results of the hydrogeologic study should be a discussion of the relationship between the aquifers and nearby surface water drainage systems as well as the relationship between the aquifers and nearby water supply wells. All water wells within a specified distance should be inventoried with water levels, pumping levels, well yields, well use, and well design all documented. All of the above information is necessary to evaluate the suitability of an area for solution mining.

Permit Procedures

Consideration should be given to requiring proof of competence in solution mining methods and techniques before an applicant is issued a pilot test permit. Adequate testing of a selected ore body should precede the issuance of a mining permit.

This pilot test would be utilized to determine the operator's capabilities to safely conduct solution mining under the specific geologic conditions. It would also allow him to evaluate his process to determine whether it is suitable for the given geochemistry of the area. We also suggest that at the end of the solution mining test the operator be required to reclaim the area to applicable standards to show his capability to reclaim the aquifer. If after the pilot test the operator has shown sufficient competence to successfully complete the mining and reclamation, he then should be granted a permit for a given area and period of time.

Included with the application should be a sufficient amount of engineering data explaining the process to be used for either a pilot test facility or a mining facility. This information should explain the process, the equipment required, and the well construction techniques to be utilized. Submitted with the engineering data should be a monitoring program to ensure the solution mining is carried out safely. This monitoring program would necessarily include monitoring wells to

determine whether or not fluids are escaping from the test site and whether or not pressure gradients in underlying and overlying aquifers are changing to indicate migration of fluids from one aquifer to another. The monitoring program should also evaluate whether or not prior exploration drill holes are leaking not only at the surface but between aquifers. Sampling should be done in the production recovery wells to determine whether or not the ions expected to be mobilized are, in fact, mobilized and those not expected to be mobilized are not mobilized.

The operator should also be required to document emergency procedures to be taken for a surface spill, leak, flooding or other problems of contamination to either personnel or equipment or the surrounding environment. Emergency procedures for controlling the escape of injection solution to underlying or overlying aquifers should be documented. As a condition of approval, the results of the monitoring program should be routinely submitted to the agency with a narrative analyzing the data.

The application should also include specific alternative methods of aquifer reclamation. The agency should realize that prior to mining, the operator may not specifically know which methods of reclamation would be most suitable. However, if the operator is required to conduct a pilot test with test reclamation, he will then know what methods will be necessary following full scale mining to adequately reclaim the aquifer. The operator should then submit a detailed plan to the agency for evaluation.

Bonding should be required to allow for reclamation of the area in case the operator fails to do so for any reason. The amount of the bonding should be sufficient to include the cost of plugging all wells, removal of surface equipment, and reclamation of the affected aquifers. Reclamation of the aquifers would be the most expensive and the most difficult to define. Regulations controlling the solution mining operator should also provide for revocation of permits, fines for infractions, and machinery for criminal punishment should the operator fail to comply with regulations.

GROUNDWATER -- TERTIARY RECOVERY OF PETROLEUM

The probability of serious groundwater contamination from the chemicals used for the tertiary recovery of petroleum appears to be limited. But, the YTAPO believes the Energy Research and Development Administration was remiss in not investigating the possible side effects of the process prior to funding a large scale experiment. As of August, 1977, the YTAPO was not able to obtain satisfactory information on the possible long-term effects of the chemicals utilized in the process. The federal agency funding the project had not prepared an environmental assessment on the project and was not able to provide the YTAPO with any information concerning the probable impact of the project.

The basic management practice recommended is, an agency without a vested interest in the success of the project review the results of the experimental project to determine the potential for loss of chemicals, and assess the probable impact of any lost chemicals prior to the initiation of a full-scale tertiary recovery program.

In addition, more rigorous procedures should be adopted for monitoring the installation and maintenance of well casings. Similarly, the plugging of wells should be monitored, including the use of cement mixtures which are chemically compatible with the water in the formations. If very corrosive conditions are encountered, plastic pipe and/or epoxy seals should be used.

While major losses of chemicals are not anticipated, procedures for the recovery of lost chemicals should be outlined in advance.

GROUNDWATER -- SALINITY

Increases in the salinity of the groundwater (or surface water) are normally induced by an evaporative loss of water causing an increase in the concentration of the salts or by the movement of the water through a zone of high salt where the water dissolves the salts out of the surrounding material.

Irrigation can cause an increase in the salinity of the shallow groundwater due to evaporative losses, or due to the irrigation of fields underlain by salty geologic formations. The recommended management practices to control excessive evaporative losses and restrict the development of irrigation over saline geologic formations are also discussed in the section on irrigation. The results of past irrigation practices -- high water tables and saline water -- can often be corrected by the installation of drain tile. The water draining from the field will have a higher salt content than the supply water, but unless the soil is inherently salty, a type of equilibrium will be reached. This equilibrium is dependent upon the irrigation techniques utilized.

A more subtle increase in the salinity of the groundwater will be caused by strip mining in the areas between the recharge and discharge zones of shallow aquifers. The current knowledge of the chemistry, permeability, etc., of the spoils that would be returned to the mined areas is not adequate to predict the exact impact of this source of salinity of groundwater and on adjacent streams. The specialists in geohydrology appear to agree something will happen, but they do not necessarily agree on the impact of the phenomenon on the surroundings.

As the magnitude of the impact is unknown, the YTAPO cannot currently justify a recommendation of prohibiting mining in areas affecting the movement of groundwater. However, such action should be kept under consideration as site specific information is developed. When proper techniques are available, sensitive areas should be delineated and mining restricted or prohibited as necessary. The selective placement of spoils in the mined area may prove to be a technique for modifying the impact of mining on the groundwater, but the effectiveness of this process has not been adequately documented.

As additional data is available, the cumulative impact of mining and expanded irrigation on the quality of the water in the Tongue River should be determined. The Tongue River system appears to be more susceptible to this type of impact than the Powder River system.

NONPOINT -- NORTHERN CHEYENNE PROGRAM

The Northern Cheyenne Indian Tribe, under contract with YTAPO, conducted a separate water quality study for the Reservation. The Reservation contains many small ponds which are used for cattle watering, irrigation and recreation. Since these ponds satisfy a considerable portion of the water requirements for the Reservation, they should not be degraded. Recommendations were developed to help prevent water quality problems.

Irrigation is just beginning to be developed on the Reservation so they have a chance to put BMP's into practice before problems start to occur.

The Northern Cheyenne are also researching proposed energy development and its effects on the water quality.

The complete Northern Cheyenne report is available from the YTAPO office.

MANAGEMENT AGENCIES

This Water Quality Management Plan is designed to be politically feasible to implement. In many instances, the acceptability of the plan to the public precluded the inclusion of managemnet practices that seemed desirable. In the same sense, it might be most efficient to establish a special water quality implementation agency, but that possibility has been ruled out in favor of utilizing existing agencies.

The law (PL 92-500) which established the guidelines for the development of the water quality plan also established certain guidelines for the agency or agencies which will implement the plan. These guidelines state that the agency must have or be in the process of obtaining the authority to:

> "(A) to carry out appropriate portions of an areawide waste treatment management plan developed under subsection (b) of this section;
> "(B) to manage effectively waste treatment works and related facilities serving such area in conformance with any plan required by subsection (b) of this section;
> "(C) directly or by contract, to design and construct new works, and to operate and maintain new and existing works as required by any plan developed pursuant to subsection (b) of this section;
> "(D) to accept and utilize grants, or other funds from any source, for waste treatment management purposes;
> "(E) to raise revenues, including the assessment of waste treatment charges;
> "(F) to incur short- and long-term indebtedness;
> "(G) to assure in implementation of an areawide waste treatment management plan that each participating community pays its proportionate share of treatment costs;
> "(H) to refuse to receive any waste from any municipality or subdivision thereof, which does not comply with any provisions of an approved plan under this section applicable to such area;
> and
> "(I) to accept for treatment industrial wastes.

The management agencies initially evaluated by the YTAPO as potentiall suitable for the implementation of the plan are listed in Table 36. After input from residents of the area and much internal discussion, the alternatives for implementation were narrowed to:

1. Utilize the Conservation Districts and other existing agencies with a central board comprised of one county commissioner from each county along with local mayors to coordinate the activities of the various agencies. The Conservation Districts would have a full-time staff member who, with assistance from the Water Quality Bureau, would provide day-to-day guidance for the program.

Table 36. SELECTED ALTERNATIVES FOR IMPLEMENTING THE 208 PLAN

Alternative Implementing Agencies	Source of Authority	Staff	Funding
Combined Effort of Conservation Districts, Planning Board, and Health Office on a County Level.	State & Local Rules	Need full time professional and/or more SCS help, Co. Planner & Zoning administrator with state assistance, full time health officer with state assistance.	County Tax & possible State and Federal
CFTSP (Coal Fields Technical Support Project)	County (also some state)	Provides technical assistance to local Government. Regulation via Conservation District & Co. Planning.	Local & Coal Tax with possible Federal grants.
YTAPO	State & County Regulatory authority delegated by state & counties	Continuation of existing YTAPO	Local & Coal Tax with possible Federal grants.
Coal Fields COG	State & County, partial delegation of state authority to COG	(Full Time equivalent of YTAPO)	Local & Coal Tax with possible Federal grants.
Water Quality Bureau (Coal Field)	State Rules	New State Staff at Colstrip with assistance from Billings & Helena.	State, Federal & Coal Tax
Water Quality Bureau (Montana)	State Rules	Existing Helena & Billings staff	State & Federal matching
EPA/USGS/SCS Coop.	Federal Rules	Regional, District & Local Office staff	Federal
U.S. Environmental Protection Agency	Federal Rules	Denver staff or new area office	Federal

2. Utilize a modified form of the YTAPO to provide the day-to-day guidance under the direction of a board comprised of local elected officials from each county. Much of the implementation is to be accomplished by the Conservation Districts, Department of State Lands, Water Quality Bureau, and local officials.

3. Establish a "Coal Fields Technical Support Group" to provide services to local units of government and take the lead role in implementing and updating the water quality management plan. As with Alternative 2 , much of the implementation would be accomplished by existing agencies.

4. Utilize the Water Quality Bureau of the Department of Health and Environmental Sciences as the lead agency. The Water Quality Bureau would implement the plan with some assistance from other existing agencies.

Implied in each of the above alternatives is the designation of each incorporated town or city as the lead agency for the management of the wastewater disposal system controlled by that unit of government. The county would be the lead agency for those areas which are unincorporated or are in a special improvement district.

FUNDING FOR THE MANAGEMENT AGENCY

The law (PL 92-500) which established the planning program also established a means of continued funding. A limited amount of federal funds are available for the continuation of the project on a 75% to 25% cost-shares basis. The local unit of government must provide one-fourth of the money to obtain the federal money. The counties involved with the YTAPO program have budgeted $2,000 to provide for the required matching money for January, 1978 through June, 1978. This will provide a total of $10,000 when the federal share is included. This is adequate for maintaining the continuity of the program but will not provide for any special equipment or a large amount of travel.

Future funding may include matching money from, 1) the Conservation Districts, who are currently restricted to a mill levy of 1.5 mills of real property value, 2) the state agencies cooperating with staff assignments, and 3) coal tax funds, state and federal. There are also rumors of federal and state legislation which would provide sources of funding for the Conservation Districts.

The municipalities and special improvement districts will utilize bond issues, etc., to finance the wastewater treatment projects that were initiated with the assistance of the YTAPO. Three of the wastewater projects were able to obtain assistance from HUD or coal tax sources.

Funds for additional personnel will be available for federal agencies with land management responsibilities (Forest Service and BLM) who can not handle the 208 program with their current staff.

A summary of the sources of funding and probable staffing for Alternatives 1 through 4 is provided in Table 37. Information on enabling legislation is contained in the supportive report on legal matter.

RECOMMENDED MANAGEMENT AGENCY

The YTAPO recommends an interim management agency similar to Alternative 2 be established. The administrator would be funded by federal money obtained by the YTAPO and by a federal/county cost-sharing program. This person would concentrate on water quality problems along with working closely with the Conservation Districts. The appointed administrator would also help set up water quality management contracts with individual farmers and ranchers with cost-sharing funded by the Culver Amendment to the Clean Water Act of 1977.

The energy planner would work in the present YTAPO area. Adding the eastern section of Bighorn County with the mining around Sarpy Creek and Decker would bring all the energy development areas into the YTAPO. The Governor would have to approve such a move. This would make it possible to apply for coal tax funding.

This energy planner could work in the Department of State Lands. The rationale for selecting the Department of State Lands is their involvement with exploration for uranium and coal (item #1 at the public meetings), their management of a significant amount of property (school lands) which could be utilized as examples of implementation of Best Management Practices, and their involvement with the regulation of coal mining and reclamation. By paying the salary and expenses of a Department of State Lands staff member the YTAPO would assume, in return, this person would concentrate his/her efforts on those matters given a high priority by the YTAPO. The location of the person within the project area instead of Helena and Billings would have physical and psychological advantages. However, the local people may feel they have little control since this person works for the Department of State Lands. For more local control, the energy planning position could be left out of the Department of State Lands. This would allow the local people a louder voice in energy development affecting their area.

Table 37. Sources of funding for the four primary management alternatives.

Lead Agency	Staff	Funding
1. Conservation Districts	Administrator plus two technicians to be hired by the Districts	Cost-shared with EPA under "208". Increased local mill levy needed to obtain matching share. Possibility of new funding via State or Federal legislation.
2. Modified YTAPO	Administrator - YTAPO	Cost-shared with EPA under "208". Administrator - match by County.
	Energy Planning Person	Cost-shared with EPA and coal tax.
3. "Coal Fields Technical Support Group"	Two to five full-time professionals	Part cost-shared with EPA under "208". Part through coal tax or federal funding.
4. Water Quality Bureau	Additional person in Billings plus support of existing staff.	One position cost-shared with EPA. Supportive personnel through normal funding.

The Montana Association of Conservation Districts was selected at the request of the local Conservation Districts and in order to utilize their experience in Southeastern Montana to assist Conservation Districts in other parts of the state.

The modified version of the Board of Directors currently in existance for the YTAPO would provide the overall guidance required by the staff.

This INTERIM MANAGEMENT AGENCY would continue until December of 1978, or as determined by the Board of Directors. Table 38 shows a proposed budget for the coming year. It is anticipated by the end of 1978, there may be an attempt to establish a relatively uniform erosion control program on a state-wide basis. Then, the structure of the interim management agency may require modification to conform to the requirements of the program. One possibility is that the Conservation Districts may need to cooperate on the hiring of professional staff members. Another possibility is that the efforts of the Soil Conservation Service may be redirected on a national basis. With the passage of the Culver Amendment to the Clean Water Act of 1977, the SCS will be directly involved in implementing the water quality management plan. The SCS will handle cost-share contracts (beginning October, 1978) with farmers and ranchers who need help with water quality related problems, i.e., erosion control, irrigation return flow, etc.

The reasons for recommending an interim management agency as opposed to the establishment of a permanent management program include the following:

1. The indecision on the part of officials assocated with the Association of Conservation Districts concerning their support for the implementation of the plan on a local level or to support a uniform, state-wide erosion control program.

2. The slow rate at which the development of coal is currently proceeding makes it difficult to justify the establishment of Alternative 3, a Technical Support Group, which is preferred by the YTAPO staff.

3. Problems associated with the YTAPO's water quality program being several months ahead of the program being run by the Water Quality Bureau for the undesignated portions of the state and problems of lag time required for other groups and agencies to respond to the directives of the Federal Clean Water Act Amendments.

Figure 9 provides a schematic of the interim management agency and its primary tasks.

ULTIMATE MANAGEMENT AGENCY

The YTAPO recommends that if the rate of development related to coal extraction and conversion increases noticeably in the near future, a "Technical Support Group" be formed to provide professional assistance to the local units of government. This group could also assume the responsibility to coordinate and update the efforts put forth under the water quality management plan. Figure 10 provides a schematic of the proposed Technical Support Group. This group could be funded by a combination of coal impact money, water quality planning money, and local matching funds.

Table 38

PROPOSED BUDGET FOR THE CONTINUATION OF THE 208 PROJECT

Expenses on a monthly basis:

Salary for full-time staff member @ $12,336/yr	$1,028
Fringe benefits for above	100
Office space rental	105
Telephone	50
Paper, postage, photocopy & office supplies	50
Travel and per diem	200
Part-time secretary/bookkeeper	400
TOTAL	$1,933

Budget for one year:

$1933 x 12 months = $23,196

Local share or possible Coal Tax funding:

$23,196 x (25%) = $5796

EPA's share:

$23,196 x (75%) = $17,397

Individual county share based on population and land area:

Carter	$600
Custer	1800
Fallon	960
Powder River	720
Rosebud	1440
Treasure	480
TOTAL	$6000

Figure 9. Schematic of interim management process.

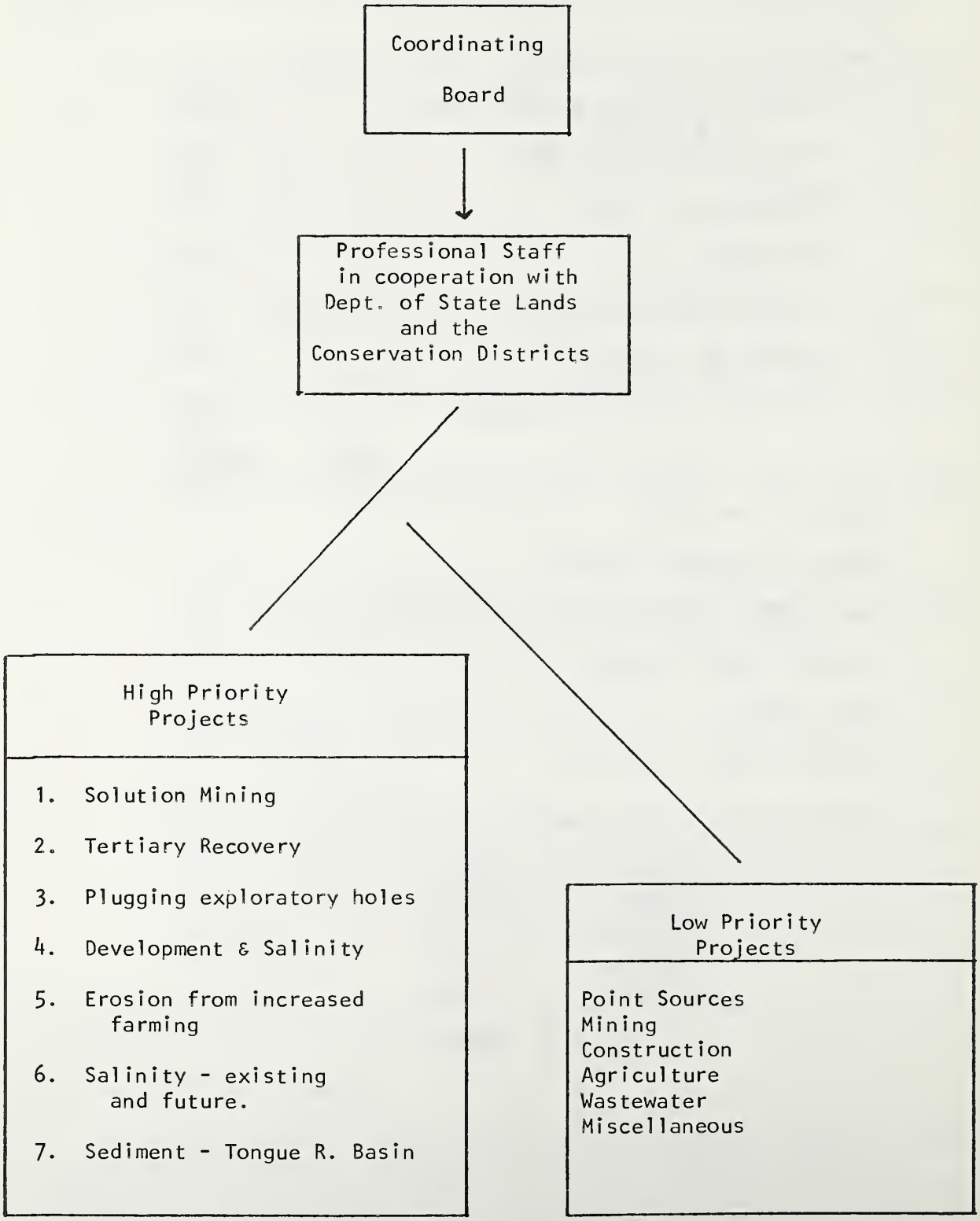
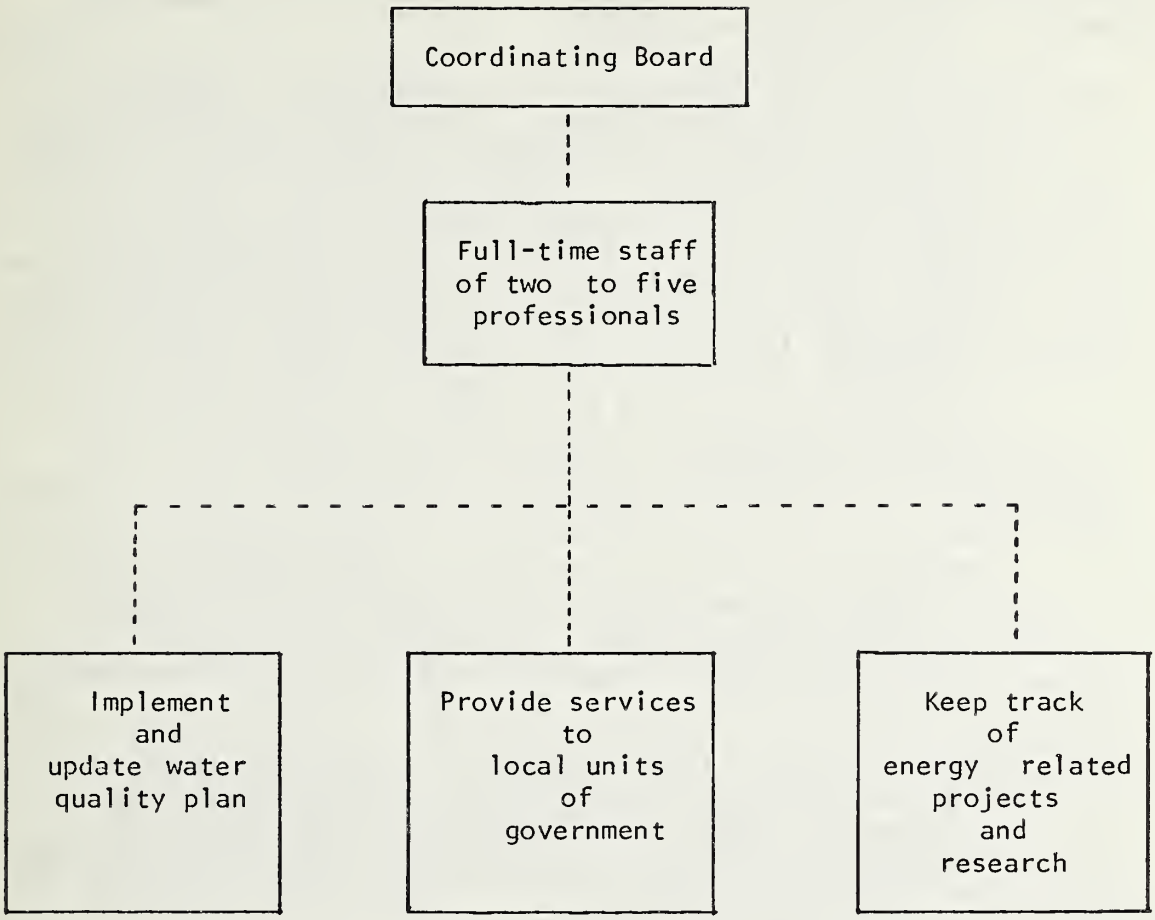


Figure 10. The "Technical Support Group".



DISCUSSION OF ADDITIONAL ALTERNATIVES

The management agencies listed above conform to existing political boundaries and utilize existing agencies and laws for any regulatory authority. Other options are possible.

1. Organize the implementation of the water quality management plan around the coal fields. If the parts of Bighorn County east of the Bighorn River and east of the Crow Indian Reservation were attached to the YTAPO project area, the coal fields would be in the same management group. This might make it easier for the agencies such as the Department of State Lands to cooperate with the management agency and may make it easier to justify submitting a request for funding to the Coal Tax Board. A problem could arise with this arrangement over who controls the individual in the field. Would the Department of State Lands have control or the locals who are putting up some of the money? This could be an issue before this option is implemented.

2. Establish an interstate region along the river basins. The management of certain water quality problems would be simplified if, as an example, the entire Powder River basin was under the same project. There would be some political difficulties due to the need to work with two state governments.

3. Separate the YTAPO into three areas -- the Little Missouri drainage to be attached to the state-wide water quality program, the Powder River drainage to establish a water quality/water rights district, and the Tongue River drainage and the Middle Yellowstone to join with parts of Bighorn County in a coal field group.

Each option has specific advantages, but all would be more difficult to establish than the alternative recommended in the preceding pages. Depending upon the views of the residents, the options have the disadvantage (or advantage) of tending to ignore Carter and Fallon Counties and the parts of Rosebud and Custer Counties north of the Yellowstone River. These areas would end up as part of the state-wide water quality program being headed by the Water Quality Bureau. Any modification of the existing boundaries of the water quality project would require the approval of the Governor.

A portion of Option 3 -- the establishment of a water quality/water rights district in the Powder River Basin -- may have merit as a part of any water management plan established in Southeastern Montana. If coal development of the magnitude anticipated by some occurs within the Powder River Basin, the conflicts over water rights and water quality will be great enough to require an on-site professional staff.

IMPLEMENTATION

The degree of a plan's successfulness is often measured by how much of the plan is implemented. The lack of implementation of many plans has caused many people to consider the process of planning a waste of money. In recognition of this image of planning, the YTAPO incorporated several action items into its program. There have been numerous tangible returns from the planning effort, even though the "Plan" itself has not been completed. Wastewater systems were planned for five communities, groundwater quality and well log information has been collected and compiled into a usable format, maps were prepared for use by county officials, gasoline was pumped from the groundwater, and guidelines were established for solution mining. These tangible results of the planning effort, to date, are hopefully an indication of better results to follow in the future.

The YTAPO has had two basic goals -- to develop a water quality management plan that would meet the requirements of the law and to do it in a way that the result is acceptable to the majority of the residents of the project area.

A series of public meetings were held to obtain input from the public. The results of these meetings have been used to establish priorities for actions to be taken during the implementation procedure. Those present at each of the public meetings were asked to rank several water quality problems or preventive actions as to having high, medium or low priority for action. Table 39 shows the results of the meetings. Table 40 presents the same information in a different fashion. The low rankings have been subtracted from the high rankings to provide a "net points" for each item. While the technique of evaluation may be open to question as it assumes the low votes were negative, the moderate votes neutral, and the high votes positive, the results are interesting.

The eight items receiving positive "net points" have been used to develop the list of high priority items used later in this chapter. Two of the items on the original list related to salinity were combined into one item as they were quite similar, resulting in seven high priority action items.

The absence of an item from the high priority list does not imply it is not critical to meeting the requirements of the Clean Water Act Amendments. It has not been placed on the list because the impact of the problem has not been severe enough to convince the residents of the area it warrants immediate action. Many of the lower priority items are listed under the implementation schedules for the various agencies. Other low priority items are covered by the Best Management Practices listed in a preceding chapter.

The public meetings also revealed many philosophies relative to the implementation of any type of program. People representing divergent views -- the fewer regulations the better versus more strict regulations to protect the public from those who do not care.

Table 39 Summary Of The Questionnaire Used At The Public Meetings

Priority Low	Priority Med	Priority Hi	
06%	25%	63%	Prevention of permanent contamination of critical aquifers by solution mining.
10%	25%	57%	Prevention of contamination of certain geologic formations with man induced chemicals utilized in the tertiary recovery of petroleum.
20%	24%	52%	Excessive erosion from large acreages of small grain crops planted without implementation of accepted soil and water conservation practices.
12%	27%	51%	Mixing of various aquifers and loss of head on confined aquifers.
17%	29%	42%	Reduction of crop yield due to the concentration of salts in the soil or shallow groundwater.
05%	31%	40%	Prevention of an increase in the salinity of the Tongue River due to the expansion of mining and irrigation.
21%	26%	29%	Prevention of a decrease in crop yields due to the improper use of saline or sodium rich water for irrigation.
17%	33%	27%	Prevention of an increase in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.
39%	30%	25%	Discharge of untreated or partly treated household wastewater to streams or to the ground surface.
46%	27%	20%	Minor surface disturbances associated with drilling gas and oil wells and most exploratory drilling.
29%	46%	19%	Excessive erosion taking place along right-of-ways.
35%	35%	15%	Increased salinity levels in the downstream part of the Powder River and resulting contribution of saline water to the Yellowstone River.
36%	13%	11%	Occasional anaerobic conditions and accumulation of wastes in a slough in the northern part of Miles City.
51%	26%	07%	Increased sediment levels in the Yellowstone River below the mouth of the Powder River.
74%	19%	04%	The contamination of streams by animal wastes.

Table 40 Summary of the results of the public meetings, with the number of low rankings subtracted from the number of high rankings to give a "net favorable" response.

Net Points	
57	Prevention of permanent contamination of critical aquifers by solution mining.
47	Prevention of permanent contamination of certain geologic formations with massive quantities of man induced chemicals utilized in the tertiary recovery of petroleum.
39	Mixing of various aquifers and loss of head on confined aquifers.
35	Prevention of a measurable increase in the salinity of the Tongue River due to the expansion of mining and irrigation.
32	Excessive erosion from large acreages of small grain crops planted without implementation of accepted soil and water conservation practices.
25	Reduction of crop yield due to the concentration of salts in the soil or shallow groundwater.
10	Prevention of measurable increases in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.
8	Prevention of a measurable decrease in crop yields due to the improper use of saline or sodium rich water for irrigation.
-10	Excessive erosion taking place along roads and other right-of-ways.
-14	Discharge of untreated or partly treated household wastewater to streams or to the ground surface.
-20	Increased salinity levels in the downstream part of the Powder River and resulting contribution of saline water to the Yellowstone River.
-25	Occasional anaerobic conditions and accumulation of wastes in a slough in the northern part of Miles City.
-26	Minor surface disturbances associated with drilling gas and oil wells and most exploratory drilling.
-44	Increased sediment levels in the Yellowsotne River below the mouth of the Powder River.
-70	The contamination of streams by animal wastes.

-- are found within the project area. The more politically conservative views appear to dominate. Even the more politically conservative people attending the meetings have expressed some concern over the actions of a minority who do not respect the desires of the majority, but they question the tradeoffs between the need for control and the disadvantages of more regulations.

Several letters were received which were concerned about trying to change winter feeding and irrigation practices. Letters of comment on the management plan will be included under separate cover to be included with the final plan presented to the Governor.

HIGH PRIORITIES

The information obtained from the public meetings was used to develop the YTAPO's list (next seven pages) of high priority problems and opportunities to prevent future problems. As five of the top seven items are primarily opportunities to prevent future problems instead of solving existing problems, the YTAPO has assumed a preventive stance instead of the corrective stance taken by most Section 208 programs.

The exact impact of the two problems given high priority by the residents of the project area could not be documented. Local professionals have supported the opinions of the citizens (and of the YTAPO staff) that the conversion of rangeland to farmland has created erosion problems. However, measurements of water quality in the streams cannot be used to prove an impact on water quality. Predictive techniques such as the universal soil loss equation and the SCS's SEDEL program could be used to approximate the amount of erosion and the percentage of the sediment moving into the drainages if such information is necessary in the future. An estimation of the impact of the mixing of various aquifers on subsurface water quality is more difficult; perhaps it would only be an educated guess. Additional groundwater information is being developed for the area by various agencies, including a Federal Bureau of Mines contract with a consulting firm to attempt to model the shallow groundwater of the coal fields area. Some professionals believe, however, that the available data is not adequate and such modeling will still be primarily in the area of highly sophisticated guesswork.

The impact of failing to seize an opportunity to prevent a water quality problem can only be estimated. The inability to predict an impact may be part of the reason solution mining, tertiary recovery, and the increase in salinity resulting from coal mining were ranked high as items to take action on. The impacts of salinity on irrigated crops (and, conversely, the impact of expanded irrigation on salinity) is better known but still somewhat vague, as some of the "textbook" information does not seem to apply to the YTAPO area. Erosion, due to disruption of the soil surface, is the least mysterious of the high priority opportunities. However, determining the amount of induced material compared to the "natural" levels of sediment may still be difficult to document except in extreme cases.

(1) OPPORTUNITY: Prevention of permanent contamination of critical aquifers by solution mining.

Background: Extensive exploration for uranium in parts of Carter County indicates the possibility of solution mining in the Fox Hills or other geologic formations. The Fox Hills formation is an important aquifer.

ACTION	PROBABLE EFFECT
A. Require the plugging of all exploratory holes.	Reduce the probability of cross contamination between aquifers. Prevent the vertical movement of mining fluid.
B. Require monitoring of the mining process and notification of "lost" mining solution.	Reduce the probability of the contamination of the aquifer outside of the active mining area.
C. Require the reclamation of the mined zone via flushing and/or neutralization.	Remove of residual contaminants to allow the future use of the aquifer. Flushing may create a residual waste problem. The contaminated water must be treated.
D. Designate an aquifer for domestic use only as outlined in the federal Safe Drinking Water Act.	Must show imminent and substantial danger to health from contaminants. Would appear difficult to substantiate at this time.

Comments: Due to the timing of the project, the YTAPO was forced to initiate these actions prior to the public meetings. A bill was introduced into the legislature to extend the moratorium on solution mining until the Water Quality Bureau could establish regulations for solution mining. Our groundwater report by Willard Owens Associates contains information for the Water Quality Bureau to use in the development of the regulations outlined above.

It is recommended that a permit program be established to control solution mining. The application for the permit should include data on the area to be mined, monitoring procedures, emergency procedures, and alternative reclamation techniques. As solution mining techniques are still somewhat experimental, a pilot test should preceed any full scale mining. A bond adequate to cover the cost of reclamation and the plugging of all wells should be required.

(2) OPPORTUNITY: Prevention of contamination of groundwater as the result of the tertiary recovery of petroleum.

Background: A large scale pilot project with the use of chemicals for the tertiary recovery of petroleum is in progress at the Belle Creek field. It is believed that the chemicals to be used, probably petroleum sulfonates, ethoxyalated alcohols and polyacryliamides, are relatively non-toxic and will be confined to the geologic formation from which petroleum is being extracted. However, as of August 5, 1977, the YTAPO has not been able to obtain satisfactory information on the possible long-term effects of these chemicals. The federal agency (ERDA) funding the experiment did not prepare an environmental assessment for the project and was not able to provide information concerning the probable impact of the project.

	ACTION	PROBABLE EFFECT
A.	Require data on the long-term effects on the chemicals and on the potential for "leakage" before any full scale project is started.	Would allow the continuation of the experimental project, but require evaluation of probable impacts prior to any major use of the process.
B.	Require an agency other than ERDA of the Oil and Gas Commission to review the results of the pilot project.	Remove the review process from those agencies which appear to have a vested interest in the success of the project.

Comments: The YTAPO believes the Energy Research & Development Administration, now part of the Office of Energy, was remiss in failing to investigate the possible side effects of the process prior to funding a large scale experiment. As the data available in early 1976 did not indicate a high probability of major problems, the YTAPO did not attempt to force the preparation of an environmental assessment on the project at the expense of stalling a major experiment on energy extraction.

The YTAPO recommends that the Oil & Gas Commission should not approve any additional work involving the micellar-polymer tertiary recovery process until the long-term effects of the process and the potential for "leakage" have been properly determined.

Supportive information is contained in our groundwater report by Willard Owens Associates.

(3) PROBLEM: The mixing of various aquifers and the loss of head on confined aquifers.

Background: Conversations with well drillers and residents of the project area indicate that the preservation of good quality groundwater is a high priority item. Past exploratory and well drilling practices have resulted in hundreds of improperly cased wells and unplugged drill holes.

ACTION	PROBABLY EFFECT
A. Regulate all drilling and require the plugging of all abandoned holes.	Would control the expansion of the problem, but would not affect the existing unplugged holes.

Comments: This recommendation is being implemented. Due to the timing of the project, action was started on this prior to the public meetings. Several discussions have been held with the Department of State Lands and other agencies. The Department of State Lands and the Oil & Gas Commission will be asked to require that all exploratory holes drilled to a depth of over 30 feet or entering groundwater be plugged with a special bentonite mixture. Plugging shall be from the bottom up, with the possible exception of seismic holes, and drill cuttings shall NOT be returned to the holes. Holes penetrating confined aquifers shall be plugged with cement which has been properly mixed so as to inhibit deterioration when in contact with the specific subsurface conditions.

Supportive information is contained in our groundwater report by Willard Owens Associates.

Additional recommendations to consider:

A. Field inspection of all drill holes. The Department of State Lands will be asked to increase the frequency of field inspections. Perhaps the maintenance of the integrity of our groundwater system is critical enough to require the inspection of all drill holes and water and petroleum wells.
B. Maintain a central data bank on all drilling. This would be expensive but may prove useful in the future.
C. Retroactive plugging of abandoned wells and drill holes. This would be quite expensive. It would also be difficult to locate the wells and drill holes.
D. Cap or valve all flowing wells. Section 89-2926 of the existing Montana water law prohibits the waste and contamination of groundwater and specifically requires that all flowing wells be valved or capped. This regulation is not enforced.

(4) OPPORTUNITY: Prevention of a measurable increase in the salinity of the Tongue River due to the expansion of mining, energy conversion, and irrigation.

Background: The expansion of irrigation will increase return flows and the extractive use of water by industry will reduce the dilution flows. Mining "uphill" from the river will cause an increase in the salinity of the groundwater that seeps into the river. However, it not currently possible to determine the exact magnitude of this potential problem. The new federal stripmining act restricts mining in alluvial valleys. The final regulations have not been released by the Department of Interior, but it looks as if little stripmining will occur in alluvial valleys.

	ACTION	PROBABLE EFFECT
A.	Restrict mining between the groundwater recharge area and the river.	As more geologic data and interpretive tools become available, certain sensitive areas should be delineated.
B.	Require selective placement of spoils in mined areas so that they will intercept the significant flows to groundwater.	The effectiveness of the procedure has not been documented.
C.	Develop waste load allocations for dissolved solids.	Difficult procedure for nonpoint sources, especially when the impact of mining will not be documented until several years after the mine is started.
D.	Attach a water quality criteria to water rights.	Guarantee that those holding existing water rights will be provided with water of usable quality.
E.	Initiate an irrigation and water quality education program.	Increase awareness over a period of years.

Comments: This is one of the best opportunities the YTAPO has to prevent the significant deterioration of a river. However, while most professionals agree on the probable effects of mining, irrigation, and flow depletion, the tools currently available are not good enough to provide firm estimates of the impacts of certain actions on water quality.

Actions A and B should be considered by the Department of State Lands whenever it reviews a mining plan. The Bureau of Land Management should also consider these impacts when it reviews recommendations for leasing.

Action C will have to be addressed by the Water Quality Bureau in the near future and Action D should be pursued in the next session of the legislature.

(5) PROBLEM: Excessive erosion from large acreages of grain crops planted without implementation of accepted soil and water conservation practices.

Background: Grazing land has been converted to grain land quite rapidly during the last few years. Adverse weather conditions could harm several hundred square miles of land. Wind erosion may be more harmful than water erosion.

	ACTION	PROBABLE EFFECT
A.	Establish an "enhanced" voluntary erosion control program through the Conservation Districts.	The control would be primarily "after the fact" in that action could not be taken against uncooperative property owners unless a problem was already in existence.

Comments: The Conservation Districts have asked to be part of the program for implementing erosion and salinity control measure. They will adopt standardized procedures for reviewing problems and attempt to obtain voluntary action on the part of the property owner. Any enforcement will be referred to existing state agencies.

Additional recommendations to consider:

A. Establish bonding and reclamation procedures.
B. Require the development of a conservation plan prior to breaking.
C. Link price supports to the utilization of soil and water conservation practices.
D. Subsidize the revegetation of marginal cropland.
E. Statewide erosion and sedimentation control program.

Comments: This is one of the more politically and socially sensitive issues the YTAPO must address. There appears to be support for the control of large property owners, but general land use controls would not be well received. If pushed, it may mean the loss of credibility and support for other portions of the YTAPO project.

(6) OPPORTUNITY: Control existing irrigation salinity problems and prevent future decreases in crop yields due to the improper use of saline or sodium-rich water.

Background: Except for the Yellowstone and Tongue Rivers, most sources of irrigation water fall within the U.S. Department of Agriculture's high or very high salinity categories. Most well water falls in the very high sodium category. Salinity has not been recognized as a problem in the past. Reduced yields due to "bad spots" in fields, etc., have been considered to be natural problems that one tolerates and works around.

	ACTION	PROBABLE EFFECT
A.	Provide salinity measuring equipment and interpretive materials to each county.	Increased awareness of salinity problems and the alternatives. Allow farmers to help themselves in determining if a problem exists.
B.	Place additional stress on salinity at farm meetings and in Vo-Ag classes.	As above.
C.	Develop a monitoring program to determine salinity levels.	Assist those using return flows and the poorer quality surface water.
D.	Establish interstate salinity maximums.	Deter Wyoming from using only good quality water and sending Montana poor quality water.
E.	Provide an awareness of possible problems when using sprinkler systems with low quality water.	Decrease the number of people stuck with systems that do not work and maintain the productivity of the soil.
F.	Require an evaluation of the water supply and the soil prior to the construction of any government funded irrigation system.	Proper interpretation of the data would indicate probable management constraints and prevent the construction of systems that would fail within a few years.

Comments: All actions should be implemented.

The YTAPO is in the process of determining what types of salinity measuring equipment are suitable and plans to obtain basic equipment for use within the project area.

The Extension Service and SCS personnel appear to be the logical choice to assist in the implementation of most of the above recommendations.

Action F is the only recommendation the YTAPO received any formal protests on after the public meeting.

(7) OPPORTUNITY: Prevention of measurable increases in the sediment load of the Tongue River due to disruption of the soil surface adjacent to the channel.

Background: Mining, construction, and agricultural activities taking place immediately adjacent to the river channel will have a noticeable impact on the river due to the short distance which the sediment would be transported.

ACTION	PROBABLE EFFECT
A. Restrict mining adjacent to the river channel.	Would control one source of sediment.
B. Restrict right-of-way construction adjacent to the river channel.	Application of strict erosion control practices to any construction that does occur.
C. Implement full conservation practices on land adjacent to the river.	Should supplement Actions A and B.

Comments: The Conservation Districts have asked to be involved with erosion control from construction sources as well as from agricultural sources. They will adopt standardized procedures for reviewing problems and will attempt to obtain voluntary action on the part of the responsible party.

An attorney working for the YTAPO has written a model right-of-way lease which incorporates safeguards for the property owner and the environment.

Roads and railroads have been traditionally constructed along rivers as the topography allows for less expensive construction. Also, it appears that the railroads have traditionally been somewhat outside the normal processes utilized for controlling erosion on construction projects, etc.

The YTAPO recommends that if manpower and finances are limited, the Tongue River area should receive priority in erosion control enforcement due to the relatively high quality of the existing river and due to the high probability of construction activities taking place near the river channel.

Return of topsoil, sediment control structures, etc., should be part of any construction projects in this area.

IMPLEMENTING AGENCIES

The YTAPO has taken the approach that whenever possible, existing agencies and programs should be used to implement the recommendations of this plan. The following pages describe the tasks delegated to each agency by the YTAPO. These agencies have not necessarily accepted these tasks and, in many instances, alternative modes of completing a task are indicated.

Approximate timetables for the implementation of each task are included. The agency indicated as the implementing agency may suggest a deviation from the recommended schedule due to funds, manpower, etc. Letters from each agency confirming or modifying the recommended schedule will be included in a supplement to the final plan.

The capability of the agency to implement a recommendation may also vary depending upon the type of action needed. These actions might be placed into four categories:

1. Implement existing agency policy such as erosion control by federal land management agencies. No regulations or similar authorization must be developed, but funds and labor may be limiting.

2. Development of agency policy not requiring special authorization such as the establishment of salinity education programs by the SCS or extension service.

3. Establish regulatory programs within the scope of activities already authorized to accomplish such as the establishment of solution mining regulations by the Water Quality Bureau.

4. Cooperate with the legislature to develop new legislation enabling the agency to accomplish a certain task such as legislation to connect water quality to water rights.

The recommendations will be placed in their approximate order of priority. Some implementing agencies will be referenced as continuing their existing program which are supportive of the water quality plan. This action is implied for those agencies being delegated specific tasks.

CONSERVATION DISTRICTS*

The Conservation Districts, with the assistance of the Montana Association of Conservation Districts, have been selected as one of the primary management agencies due to its existing authority to:

1. Develop guidelines for the implementation of Best Management Practices on agricultural land.
2. Enter into agreements with other agencies.
3. Implement regulatory programs upon the approval of the voters within the District.

Recommended Activities:

A. Establish an aggressive but nonregulatory program to correct erosion and salinity problems within each District. This program should include the development of a cooperative agreement with the Water Quality Bureau to relieve the Districts of the need to establish a regulatory program and an agreement with the Montana Association of Conservation Districts to provide technical assistance to the Districts.

   a. Full-time technical assistance, possibly through the Association cooperating with the YTAPO . . . . . Nov. 1977

   b. Development of cooperative agreement with the Water Quality Bureau . . . . . Jan. 1978

   c. Interim measures -- use of standard SCS guidelines and data developed for the YTAPO . . . . . Jan. 1978

   d. Refinement of local guidelines for erosion and salinity control (Best Management Practices) . . . June 1978

B. Evaluate the need for a uniform, state-wide sediment and salinity control program as currently being considered by the Association. If necessary, develop and implement the guidelines and legislation required to replace Recommendation "A" with this approach.

   a. Formulation of proposed guidelines and legislation . Nov. 1978

   b. Support legislation and/or attempt to pass local sediment and salinity control ordinances . . . . . May 1979

C. Support those conservation practices required to correct major trouble spots . . . . . continuous action starting Jan. 1978.

D. Bring land in Custer County into North Custer Conservation District . . . . . continuous.

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

DEPARTMENT OF STATE LANDS *

The Department of State Lands has been selected as one of the primary lead agencies due to its existing authority to:

1. Regulate exploration for coal and uranium.
2. Regulate the act of surface mining.
3. Manage approximately 5% of the land within the project area known as "school sections".

Recommended Activities:

A. Assume lead role in the development of proper plugging procedures for exploratory drilling, including the implementation of the plugging procedures recommended in this report, the modification of those procedures as necessary, and the development of field inspection techniques.

   a. Partial implementation of plugging procedures . . . . Jan. 1978

   b. Development of field inspection techniques . . . . . Nov. 1978

   c. Modification of procedures as necessary and the full implementation of the plugging program . . . . Jan. 1979

B. Assist the Water Quality Bureau in the development and implementation of regulations for the solution mining of uranium.

   a. Review proposed regulations . . . . . Nov. 1977

   b. Assist in implementation as necessary . . . . . 1978, etc.

C. Adopt suggested modifications of regulations governing the strip mining of coal and pursue the actions necessary to answer the questions raised by the section of the "enhancement of the existing regulatory program".

   a. Adopt recommended modifications . . . . . May 1978

   b. Pursue additional actions to update regulations . . . 1978, etc.

D. Provide assistance to those who prepare legislation to revise the Department policy concerning management of school lands. Specifically, change the criteria of management for maximum returns to a criteria requiring the maintenance of long term productivity. Such criteria would not be intended to prohibit mining, but to require long term productivity as opposed to immediate economic returns as the primary goal when reclaiming mined land and when managing agricultural lands.

   a. Assist the legislature (upon request) . . . . . Jan. 1979

   b. Implement the criteria (if passed by the legislature) 1979, etc.

E. Implement commonly accepted erosion control practices on all school lands, including, but not limited to grassed waterways and crop residue management. Provide for an adequate inspection process. As the only government agency allowing cropping of its lands, the Department is obligated to provide an extra degree of professional land management not required by those agencies leasing land only for grazing purposes.

a. Develop management guidelines incorporating those management techniques normally accepted by the SCS when developing farm plans and including the crop residue guidelines developed under the 208 program . . . . . Nov. 1978

b. Provide initial staffing required to implement the guidelines . . . . . Nov. 1978

c. Accomplish full implementation of Best Management Practices on school lands. . . . . Nov. 1983

F. Provide cooperative staffing to assist the YTAPO in making the transition from planning to implementation. A direct implementation of this is the placement of staff members in the field to increase their accessibility and visibility to the residents of Eastern Montana.

a. Cooperative staffing with the YTAPO . . . . . .indefinite

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

WATER QUALITY BUREAU *

The Water Quality Bureau of the Department of Health and Environmental Sciences has been selected as one of the primary management agencies due to its existing authority to:

1. Establish standards for the protection of state waters and enforce such standards.
2. Determine conditions for and issue permits for point source discharges of pollutants to state waters.
3. Regulate the solution mining of uranium.
4. Provide technical assistance, including the capability to perform laboratory analysis for water contaminants.
5. Administer Federal Construction Grant program.

Recommended Activities:

A. Develop and implement a regulatory program to control the solution mining for uranium as authorized by the 1977 session of the Montana legislature.

   a. Develop the necessary regulations . . . . . Oct. 1977

   b. Provide notice of and adopt the regulations . . . . . Feb. 1978

B. Issue and monitor permits for point source discharges of pollutants (continuation of existing program).

C. Provide technical assistance, including laboratory analysis as required (continuation of existing program).

D. Enter into cooperative agreements with the Conservation Districts and assist them in controlling major nonpoint source problems until a permanent erosion and salinity control program has been established . . . . . Jan. 1978

E. Modify the stream classifications and criteria to reflect the recommendations made in this report . . . . . Dec. 1977

F. Determine the feasibility of developing waste load allocations for nonpoint source dissolved solids. . . . . May 1978

G. Revise household wastewater guidelines . . . . . May 1978

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

ROSEBUD, CUSTER AND POWDER RIVER COUNTIES, AND THE INCORPORATED COMMUNITIES OF BAKER, BROADUS, EKALAKA, FORSYTH, HYSHAM, MILES CITY AND PLEVNA *

These counties and incorporated communities have been selected as primary management agencies due to their existing authority to:

1. Design, construct and manage wastewater treatment facilities.

2. Establish and enforce regulations concerning the treatment and disposal of household and industrial wastes.

3. Accept or raise the funds necessary to construct and maintain wastewater treatment facilities.

Each county and community will be responsible for those requirements of Section 208 of PL 92-500 related to urban runoff, solid waste, and municipal wastewater treatment systems.

Recommended Activities:

Rosebud County: Maintenance of existing facility at Ashland and the completion of construction of wastewater treatment facilities for the communities of Rosebud and Colstrip and insure that they are operated properly. (Start up of both by June 1978)

Custer County: Continuation of planning and eventual construction of wastewater treatment facilities for the Haynes Avenue vicinity. (Engineering plans revised by April 1978. Bids opened by June 1978, construction completed by November 1978.)

Powder River County: Insure the proper operation of the Belle Creek sewage treatment facility. Establish proper wastewater treatment if any unincorporated communities develop within the coal fields area.

Baker: Bring existing wastewater treatment facility into compliance with state regulations, including the submission of proper analysis of samples taken from the existing and future systems.

Broadus: Bring existing wastewater treatment facility into compliance with state regulations. (Engineering plans completed by April 1978, bids open by June 1978, construction completed by November 1978.)

Ekalaka: Bring existing wastewater treatment facility into compliance with state regulations. (Initiate facility planning by January 1981, complete engineering planning by September 1981, bids opened by January 1982, construction completed by July 1983.)

Forsyth:	Complete and maintain wastewater treatment facility already designed. (Full operational status of facility by July 1978)
Hysham:	Bring existing wastewater treatment facility into compliance with state regulations. (Engineering plans completed by April 1978, bids opened by June 1978, construction complete by November 1978.)
Miles City:	Complete and maintain the wastewater treatment facility already designed. (Bids opened by November 1977, construction complete by November 1978.)
Plevna:	Operate and maintain existing wastewater treatment facility.

* The YTAPO recommends the Governor designate these agencies as responsible for the implementation of portions of the 208 plan.

YELLOWSTONE-TONGUE APO *

The Yellowstone-Tongue APO has been selected as one of the primary management agencies due to its existing authority to:

1. Enter into cooperative agreements with several agencies and provide for the coordination of several related activities.

2. To accept funds, maintain staffing, and revise the plan as needed.

The YTAPO has no direct ability to enforce any regulations related to water quality. It can provide technical assistance and coordinate the efforts of other agencies.

Recommended Activities:

A. Provide technical assistance to the Conservation Districts and the Department of State Lands on a cooperative basis.

   a. Cooperative staffing with the Dept. of State Lands . . . . indefinite

   b. Cooperative staffing with the Conservation Districts . . . Oct. 1978

B. Provide the annual revision of the plan. This would occur each year after the plan is accepted by the Governor and the EPA.

C. Assist in the formation of a "Technical Advisory Group" to provide technical assistance to the local units of government being affected by the extraction and conversion of coal. The YTAPO would establish the "Technical Advisory Group" (to supersede the YTAPO) when coal development becomes more active and the expense of maintaining the professional staff can be justified.

D. Work with the new Office of Surface Mining when it opens a branch in Billings to keep current on mining plans and potential water quality problems.

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

NORTHERN CHEYENNE INDIAN TRIBE*

The Northern Cheyenne Indian Tribe has been selected as one of the primary management agencies due to its existing authority to develop and enforce guidelines and regulations for land within the Northern Cheyenne Indian Reservation. The Northern Cheyenne Research Project will provide technical assistance to the Tribe.

Recommended Activities:

A. Establish a process for determining the desirable locations for new housing developments, including the development of maps indicating sensitive areas.

   a. Development of basic process and first set of maps . . . Nov. 1977

   b. Completion of mapping process . . . . . Nov. 1978

B. Implementation of Best Management Practices as recommended for agricultural and forestry by the 208 report developed by the Research Project . . . . . .
   50% of land area Dec. 1979
   90% of land area Dec. 1983

C. Development of regulations regarding the extraction of coal and the delineation of sensitive areas relative to surface mining, if surface mining is anticipated within the Reservation.

   a. Draft copy of proposed regulations and trial set of maps . . . . . Dec. 1977

   b. Revised regulations and 50% completion of delineation of sensitive areas . . . . . Dec. 1978

   c. Completion of delineation of sensitive areas . . . . . Dec. 1979

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

U.S. ENVIRONMENTAL PROTECTION AGENCY*

The U.S. Environmental Protection Agency has been selected as one of the primary management agencies due to its existing authority to develop limitations and issue permits for point source discharges on Indian lands and from federal installations. The EPA also has approval authority over the water quality management plan and can provide technical assistance to other agencies responsible for the implementation of the plan.

The EPA will not be involved in the direct implementation of the plan except as follows:

1. Issuance of discharge permits to municipal and industrial discharges on the Northern Cheyenne Indian Reservation. (Currently there are no industrial discharges.)

2. Issuance of discharge permits for federal installations. (Examples being the fish hatchery at Miles City which may need a discharge permit if it is rebuilt, and the agricultural experiment station, if it cannot be included within the general permit for irrigation.)

The only known discharge falling under the above guidelines which does not have a permit is the Busby lagoon system.

3. Assure compatability between YTAPO 208 program and Powder River 208 program in Wyoming and Water Quality Standards at the border.

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

U.S. FOREST SERVICE*

The Forest Service has been selected as one of the primary lead agencies due to its existing authority to:

1. Regulate leasing and exploration for coal, oil and uranium on its land.

2. Regulate grazing, timber harvesting, and road building on its land.

3. Manage approximately 5 percent of the land within the project area.

Recommended Activities:

A. Full implementation of existing watershed management practices, with more attention paid to the maintenance and possible reclamation of trails and roads and to grazing in sensitive areas . . . . . continuous

B. Control off-road vehicle traffic following wet weather . . . . . July 1975

C. Submit timber and grazing plans to 208 for review .. continuous

BUREAU OF LAND MANAGEMENT*

The Bureau of Land Management has been selected as one of the primary lead agencies due to its existing authority to:

1. Regulate leasing and exploration for coal, oil and uranium on land under its control.

2. Regulate grazing.

3. Manage approximately 11 percent of the land within the project area.

Recommended Activities:

A. Implementation of Best Management Practices on all surface ownership . . 50% accomplishment . . . Dec. 1982
90% accomplishment . . . Dec. 1985

B. Evaluation of impact of mining on water quality prior to leasing . . . . . as needed

C. Submit Management Framework Plans to 208 for review .. continuous

D. Submit proposed projects affecting water quality under the new Surface Mining Act to 208 for review . . continuous

* The YTAPO recommends the Governor designate this agency as responsible for the implementation of portions of the 208 plan.

AGENCIES ASSISTING IN IMPLEMENTATION

Several agencies will be asked to assist in the implementation of the water quality management plan, but will not be designated as primary management agencies by the Governor of Montana.

The following pages describe the tasks delegated to these agencies by the YTAPO. The agencies have not necessarily accepted these tasks.

COUNTY PLANNERS: The County Planners have limited direct authority to control erosion, etc., but in their advisory role to the County Planning Commissions and the County Commissioners, they can provide the technical and interpretative assistance needed to avoid water quality problems related to future developments. The County Planners can also assist in determining the need for the establishment of the "Technical Support Group" in the event of expanded coal extraction and conversion.

a. Increase the awareness of local officials to problems associated with probable future developments . . . . . continuous

b. Assist in the formation of the "Technical Support Group" if coal extraction and conversion expands . . . . . indefinite

c. Assist in the annual revision of the water quality management plan . . . . . annually

d. Review subdivisions proposed in high hazard areas, with assistance from SCS . . . . . continuous

COUNTY SANITARIANS: The County Health Officer and his field representative, the County Sanitarian, have relatively broad powers to control any water quality problem which presents a health hazard. As a result, these local officials have an excellent capability to respond to unpredicted problems as well as handle expected problems such as with septic tank systems.

a. Provide a continuous monitoring service for critical local problems and assist in revising the water quality management plan . . . . . continuous

b. Develop and adopt household wastewater regulations that reflect the needs of each county. Permit systems may not be necessary in the rural areas. As there is no state regulation covering the installation of household systems outside new subdivisions, each county should have a basic ordinance, otherwise enforcement occurs only when a documentable health hazard exists. (This could be accomplished by adopting the guidelines printed by the state, if the state revises them.) . . . . . July 1978

DEPARTMENT OF NATURAL RESOURCES & CONSERVATION: The Department has a professional staff concerned with water resources planning and with water rights. They also provide a limited amount of technical assistance to the Conservation Districts.

a. Provide assistance to develop future legislation linking water quality to water rights . . . . . Nov. 1978

b. Require evaluation of soil and water conditions for potential salinity or other hazards prior to recommending or funding irrigation developments. The correlation of proposed projects with the results of old projects, use of soils data and long-term water quality records, etc., are preferable to grab samples of surface water supplies. Groundwater sources should be sampled individually. . . continuous

c. Provide data concerning the amount of water required to satisfy existing water rights for the revision of the plan 1979

d. Evaluate the need for one or more full-time water quality/water rights specialists to act as sophisticated "ditch riders" for the Powder River 1979

e. Review any future water rights applications or developmental plans for their impact on water quality, especially to determine if such developments would cause a violation of the proposed 750 umho limit on the Tongue and 2250 umho limit on the Powder River . . . . . continuous

f. Water rights applications for processes that totally consume or export water from the drainage should request the lower quality water within the basin. (Probably not currently enforceable. Applies to tributaries in Wyoming also).

g. Consider the role of nonpoint source sediment and salinity management if such role is not accepted by the Conservation Distrcits or the Water Quality Bureau.

DEPARTMENT OF FISH & GAME: The Department has established a reputation as the most "quality oriented" of the agencies working in Montana. Their current involvement in nonpoint source sediment or salinity control is primarily restricted to the cooperative evaluation of proposed stream channel modifications.

a. Provide assistance in the revision of the plan . . . . annually

b. Provide a critical review of stream modifications . . . continuous

c. Consider the role of nonpoint source sediment and salinity management if such role is not accepted by the Conservation Districts or the Water Quality Bureau.

ENVIRONMENTAL QUALITY COUNCIL:

a. Provide a critical review of the probable impacts of major projects in the YTAPO area and notify the YTAPO or the proper designated management agency or any adverse impacts that should be moderated . . . . . continuous

b. Provide recommendations for the revision of the plan . annually

STATE HIGHWAY DEPARTMENT:

a. Establish a more functional process for enforcing the installation of erosion control practices recommended in environmental assessments and/or required in contracts, including the expansion of the existing staff (a person in the Billings office). Provide those staff members with authority to require the implementation of critical practices when on on-site inspections instead of only being able to provide recommendations through the "proper channels" . . . . . July 1978

b. Establish an in-house maintenance program for erosion control practices installed in critical areas (as along the Tongue and Yellowstone Rivers) . . . . . July 1978

c. Establish erosion control practices in critical areas where such practices were not required or where the requirements for such practices were not enforced in the past (as along the southern end of the reconstructed highway near the Tongue River.) . . . . . .July 1978

d. Restrict the use of soil sterilants along road fills and near bridge abutments if the growth of vegetation is not causing a traffic hazard . . . . . .July 1978

e, Eliminate disposal of residual wastes via dumping at convenient roadside sites . . . . . Nov. 1977

f. Submit new highway plans to 208 for review . . . . . continuous

OIL AND GAS COMMISSION

a. Modify seismic hole plugging procedures to prohibit the return of drill cuttings to the holes unless they can be mixed with the plugging fluid without degrading the resulting mix. Reguire a reasonable approximation of plugging from the bottom up. The plugging guidelines should follow those being developed by the Dept. fo States Lands. Prohibit return of cuttings and require plugging of all holes . . . . . Jan. 1978

b. Modify plugging procedures to follow those developed by the Dept. of State Lands, including a minimum drill to plug time. . . . . Jan. 1979

c. Request a neutral agency to review the results of the ERDA funded tertiary recovery project at the Belle Creek field, including an evaluation of the possible long term effects of the process prior to authorization of any full scale use of the technique.

BUREAU OF MINES AND GEOLOGY:

a. Provide assistance in revising the portion of the plan related to the impact of mining on the groundwater . . 1979

b. Revise and update the groundwater data files as new information is available . . . . . continuous

SUBDIVISION BUREAU, DHES:

a. Assist in the revision of the household wastewater guidelines, including a provision for the use of alternative systems under selected conditions . . . . May 1978

b. Review proposed developments for the adequacy of residual waste (including wastewater) disposal . . . . continuous

AIR QUALITY BUREAU, DHES:

a. Evaluate air pollution control programs to prevent adverse impacts on water quality through the use of chemicals for particulate control, the disposal of residual sludges, etc. . . . . continuous

SOLID WASTE BUREAU, DHES:

a. Evaluate solid waste disposal programs to prevent adverse impacts on water quality . . . . . continuous

b. Submit plans of new disposal sites for 208 review . . . . . continuous

ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION:

a. Properly evaluate the probable long-term effects of energy resource recovery projects such as the tertiary recovery of petroleum project prior to providing funding. . . . . continuous

b. Provide the results of the hydrogeochemical sampling for the annual update of the plan . . . . . Jan. 1979

INTERSTATE COMMERCE COMMISSION:

a. Provide information on the probable railroad activities within the area for the annual update of the plan . . Jan. 1979

b. Require the implementation of Best Management Practices regarding erosion and water quality on all railroad lines within the project area
(existing lines) 50% accomplishment . . . . . Dec. 1982
90% accomplishment . . . . . Dec. 1985
(new lines) full implementation as built

c. Submit new railroad plans to 208 for review . . . . . continuous

SOIL CONSERVATION SERVICE:

a. Assist the Conservation Districts . . . . . continuous

b. Work with Extension Service personnel to develop salinity and erosion education programs . . . . . continuous

c. Assist the Extension Service in establishing salinity monitoring programs through assistance to property owners and through the high schools. . . . . Nov. 1978

d. Assist in establishing green belts along stream channels for control of stream channel erosion
50% accomplishment 1985
90% accomplishment 1990

AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE:

a. Require an evaluation of the potential for salinity problems prior to funding irrigation related projects . . . . . July 1978

b. Emphasize funding of projects that are of primary benefit to persons downstream from the property owner or those practices which have long-term benefits valuable to the public, but which may not be economically advantageous to the property owner . . July 1978

c. Consult 208 program regarding selection of acreage to set aside in future acreage Set-Aside Programs . . . . . continuous

CORPS OF ENGINEERS:

a. Control of major channel modifications as sources of pollutants on the Yellowstone, Tongue and Powder River mainstems . . . . . continuous

b. Submit proposed projects to 208 program for review including projects in Wyoming affecting YTAPO area . . continuous

BUREAU OF RECLAMATION:

a. Evaluate soil capabilities and quality of water supply relative to salinity or related problems prior to recommending or funding any irrigation system . . . continuous

U. S. GEOLOGICAL SURVEY:

a. Review of the YTAPO's recommendations for stream sampling and the continuation of a sampling program . . . . . continuous

b. Streamline procedures for getting the data to the public . . . . . continuous

c. Provide assistance to the state and local units of government in establishing an adequate data base for the coal fields vicinity. . . . . continuous

d. Submit Northern Powder River EIS to 208 for review . . when completed

COOPERATIVE EXTENSION SERVICE:

a. Work with Soil Conservation Service personnel to develop salinity and erosion education programs . . . . . continuous

b. Develop an irrigation water and soils salinity program to be used in the high schools . . . . . Nov. 1978

OFFICE OF SURFACE MINING RECLAMATION ENFORCEMENT:

a. Implement mining regulations on federal lands . . . . . Feb. 1978

b. Review of the process developed by the Department of State Lands for the implementation of mining regulations within the State of Montana . . . . . Aug. 1978

YELLOWSTONE RIVER COMPACT

a. Establish a method for determining the allowable degradation of interstate water by the upstream areas . . . . . Dec. 1978

[illegible] A[illegible] [illegible] initiat[illegible] which [illegible] a Water [illegible] from [illegible] the [illegible] Carter, Custer [illegible] Powder [illegible] Rosebud, and Treasure [illegible] and the North [illegible]nne Indian Reser[illegible]

The project will [illegible] developing a progr[illegible] [illegible]ed t[illegible] [illegible] quality [illegible] the [illegible] and the groundwater within the area.

Parts of this water quality management program have already been developed. Additional material will be developed in the near future. As this material will contain guidelines [illegible] the control [illegible] sediment and salinity as well as domestic and industrial wastes [illegible] would be interested in reviewing and commenting on it.

[illegible], [illegible] public meetings will be held to discuss this material and to obtain input from [illegible]ed citizens. The exact time and location [illegible] these meetings will be announced in [illegible] newspaper. They are tentatively scheduled for:

Forsyth	July 18, 1977
Miles City	July 19, 1977
Ekalaka	July 20, 1977
Broadus	July 21, 1977

For additional information, write the Yellowstone-Tongue Water Quality Project in Broadus, Montana, 59317 or call collect (436-2802).

BULK RATE
U.S. POSTAGE PD.
BROADUS, MT.
Permit No. 03

WATER QUALITY MANAGEMENT PROJECT

YELLOWSTONE-TONGUE A.P.O.
P.O. Box 503
Broadus, Montana 59317
406 436 2802 or 406 436 2816

To

POSTAL PATRON
LOCAL

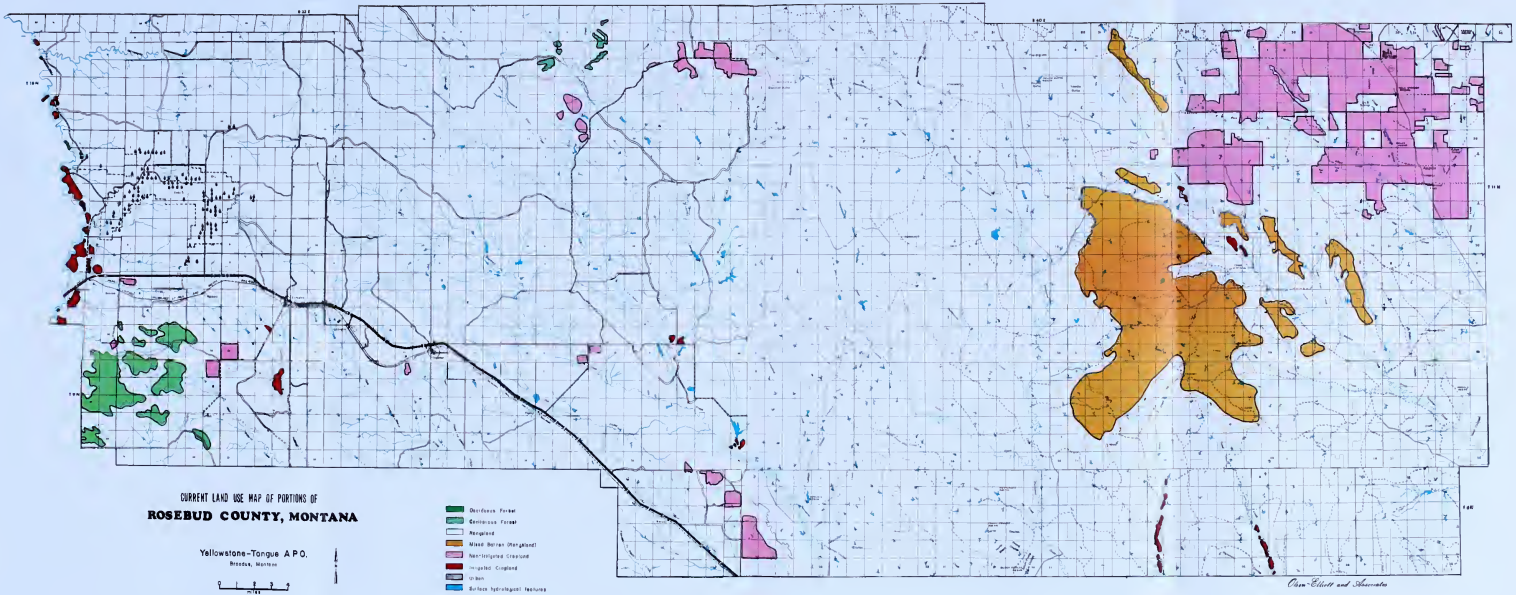
MAP SYMBOLS

Feature	Symbol	Feature	Symbol	Feature	Symbol	Feature	Symbol
Road All Weather	Divided	Principal Access	Divided	Buildings		Towns and Cities	
Road Seasonal Use		Solid waste dump	W	Buildings (Abandoned)		River or Large Stream	
Road "Jeep" Type "Primative"		Road Interchange		BLM Office		Stream	
Trail		Rest Area		School		Large Dam	
Railroad Double Track		Sand or gravel quarry		Church		Reservoir or Retention Dam	
Railroad Single Track		Scoria mine Bentonite mine		Radio Installation		Lake or Pond	
Glacier		Levee or Dike		Fire Lookout (Primary)		Intermittent Lake or Pond	
Road Bridge		Corral		Fire Lookout (Secondary)		Dry Lake or Pond	
Railroad Bridge		Recreation Site		Fire Tool Cache		Marsh	
Foot Bridge		Tanks-(label as to type)		Shelter		Spring	
Ferry		Gas wells		Cliff Dwelling		Improved Spring	
Road Ford		Oil wells		Ruins Small Large	Ruins Ruins	Well	
Trail Ford		US Mineral or Location Monument		Cemetery	CEM	Artesian Well	
Road Tunnel		Located Object (Labeled)		Sawmill		Windmill	
Railroad Tunnel		Triangulation Station	Dog	Airfield		Aqueduct Tunnel	
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

Data sources for the Current Land Use Map include the following:

Base Maps - Bureau of Land Management Surface Management Quads [illegible]
Boundar Recreation Map; Montana Dept. of Highways [illegible]

Data Sources - Skylab Photography; 1973 Landsat Imagery (April, 1976);
U.S.G.S. Aerial Photography (1972); B.L.M. Planning Unit Data [illegible]
Montana Dept. of Natural Resources and Conservation [illegible]
Soil Conservation District and Current Land Use Data [illegible]
Other Montana State Agencies


CURRENT LAND USE MAP OF PORTIONS OF
ROSEBUD COUNTY, MONTANA
Yellowstone-Tongue A.P.O.
Broadus, Montana
Deciduous Forest
Coniferous Forest
Rangeland
Mixed Barren (Rangeland)
Non-Irrigated Cropland
Irrigated Cropland
Urban
Surface hydrological features
Owen-Elliott and Associates

The Yel[illegible]e Area [illegible] vehicle for a Water Quali[illegible], Project [illegible], Carte[illegible] [illegible]ombud, and Treasure Count[illegible] and the [illegible]cone Indi[illegible] reservat[illegible]

The project will be develop[illegible] program [illegible] the quality of the river and the groundwater within the area

Parts of this water quality management program have already been developed Additional materials will be developed in the near future As this material will contain guidelin[illegible] for the control of sediment and salinity as well as domestic and industrial wastes, every[illegible] should be interested in reviewing and commenting on it

A series of public meetings will be held to discuss this material and to obtain input fro[illegible] interested citizens The exact time and locations of these meetings will be announced i[illegible] the newspaper They are tentatively scheduled for

Forsyth	July 18, 1977
Miles City	July 19, 1977
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For additional information, write the Yellowstone-Tongue Water Quality Project in Broadus Montana, 59317; or call collect (436-2802)

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WATER QUALITY MANAGEMENT PROJECT

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P O Box 503
Broadus Montana 59317
406-436 2602 or 406 436-2816

To

POSTAL PATRON
LOCAL

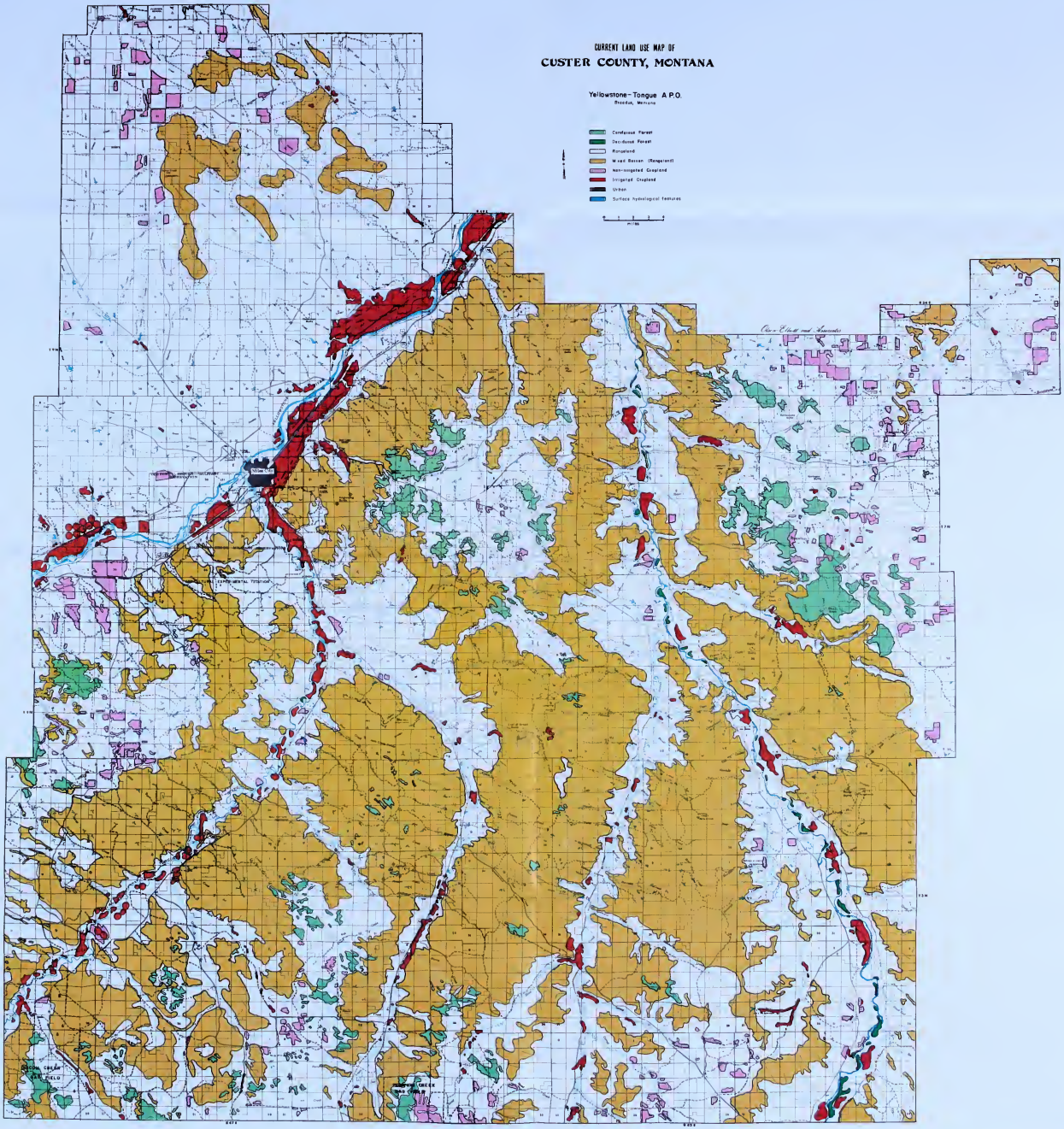
MAP SYMBOLS

Feature	Symbol	Feature	Symbol	Feature	Symbol	Feature	Symbol
Road All Weather	Divided	Principal Access	Divided	Buildings		Towns and Cities	
Road Seasonal Use		Solid waste dump	W	Buildings (Abandoned)		River or Large Stream	
Road "Jeep" Type "Primitive"		Road Interchange		BLM Office		Stream	
Trail		Rest Area		School		Large Dam	
Railroad Double Track		Sand or gravel quarry		Church		Reservoir or Retention Dam	
Railroad Single Track		Scoria mine Bentonite mine		Radio Installation		Lake or Pond	
Glacier		Levee or Dike		Fire Lookout (Primary)		Intermittent Lake or Pond	
Road Bridge		Corral		Fire Lookout (Secondary)		Dry Lake or Pond	
Railroad Bridge		Recreation Site		Fire Tool Cache		Marsh	
Foot Bridge		Tanks-(label as to type)		Shelter		Spring	
Ferry		Gas wells		Cliff Dwelling		Improved Spring	
Road Ford		Oil wells		Ruins Small Large	Ruins Ruins	Well	
Trail Ford		US Mineral or Location Monument		Cemetery	CEM	Artesian Well	
Road Tunnel		Located Object (Labeled)		Sawmill		Windmill	
Railroad Tunnel		Triangulation Station	Dog	Airfield		Aqueduct Tunnel	
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

Data sources for the Current Land Use Map include the following

Base Maps - Bureau of Land Management Surface Management Quads [illegible]
Boaterlar Recreation Map, Montana Dept. of Highways (19[illegible])

Data Sources - Skylab Photography, 1973 Landsat Imagery (April 1976);
U.S. & S. Aerial Photography (1972); B.L.M. Planning Unit Data ([illegible]);
Montana Dept. of Natural Resources and Conservation Irrigation Maps (19[illegible])
Soil Conservation District and Current Land Use Data (1969 to current)
Other Montana State Agencies


CURRENT LAND USE MAP OF
CUSTER COUNTY, MONTANA
Yellowstone-Tongue A.P.O.
Broadus, Montana
Coniferous Forest
Deciduous Forest
Rangeland
Mixed Barren (Rangeland)
Non-Irrigated Cropland
Irrigated Cropland
Urban
Surface hydrological features
MILES
Miles City
Miles City Municipal Airport
Fort Keogh Experimental Station
Ashland
Birney
Colstrip
Rosebud
Forsyth
Hysham
Custer
Locate Check and Generate

The Yellowstone-Tongue Area Wide Planning Organization is the vehicle for a Water Quality Project that includes Carter, Custer, Fallon, Powder River, Rosebud, and Treasure Counties and the Northern Cheyenne Indian Reservation.

The project will be developing a program designed to maintain the quality of the rivers and the groundwater within the area

Parts of this water quality management program have already been developed. Additional materials will be developed in the near future. As this material will contain guidelines for the control of sediment and salinity as well as domestic and industrial wastes, everyone should be interested in reviewing and commenting on it

A series of public meetings will be held to discuss this material and to obtain input from interested citizens. The exact time and locations of these meetings will be announced in the newspaper. They are tentatively scheduled for:

Forsyth. . .	July 18, 1977
Miles City . . .	July 19, 1977
Ekalaka.	July 20, 1977
Broadus. . . .	July 21, 1977

For additional information, write the Yellowstone-Tongue Water Quality Project in Broadus, Montana, 59317; or call collect (436-2802)

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WATER QUALITY MANAGEMENT PROJECT

YELLOWSTONE-TONGUE A.P.O.
P O Box 503
Broadus, Montana 59317
406 436 2802 or 406-436-2816

To

POSTAL PATRON
LOCAL

MAP SYMBOLS

Feature	Symbol	Feature	Symbol	Feature	Symbol	Feature	Symbol
Road All Weather	Divided	Principal Access	Divided	Buildings		Towns and Cities	
Road Seasonal Use		Solid waste dump	w	Buildings (Abandoned)		River or Large Stream	
Road "Jeep" Type "Primitive"		Road Interchange		BLM Office		Stream	
Trail		Rest Area		School		Large Dam	
Railroad Double Track		Sand or gravel quarry		Church		Reservoir or Retention Dam	
Railroad Single Track		Scoria mine Bentonite mine		Radio Installation		Lake or Pond	
Glacier		Levee or Dike		Fire Lookout (Primary)		Intermittent Lake or Pond	
Road Bridge		Corral		Fire Lookout (Secondary)		Dry Lake or Pond	
Railroad Bridge		Recreation Site		Fire Tool Cache		Marsh	
Foot Bridge		Tanks-(label as to type)		Shelter		Spring	
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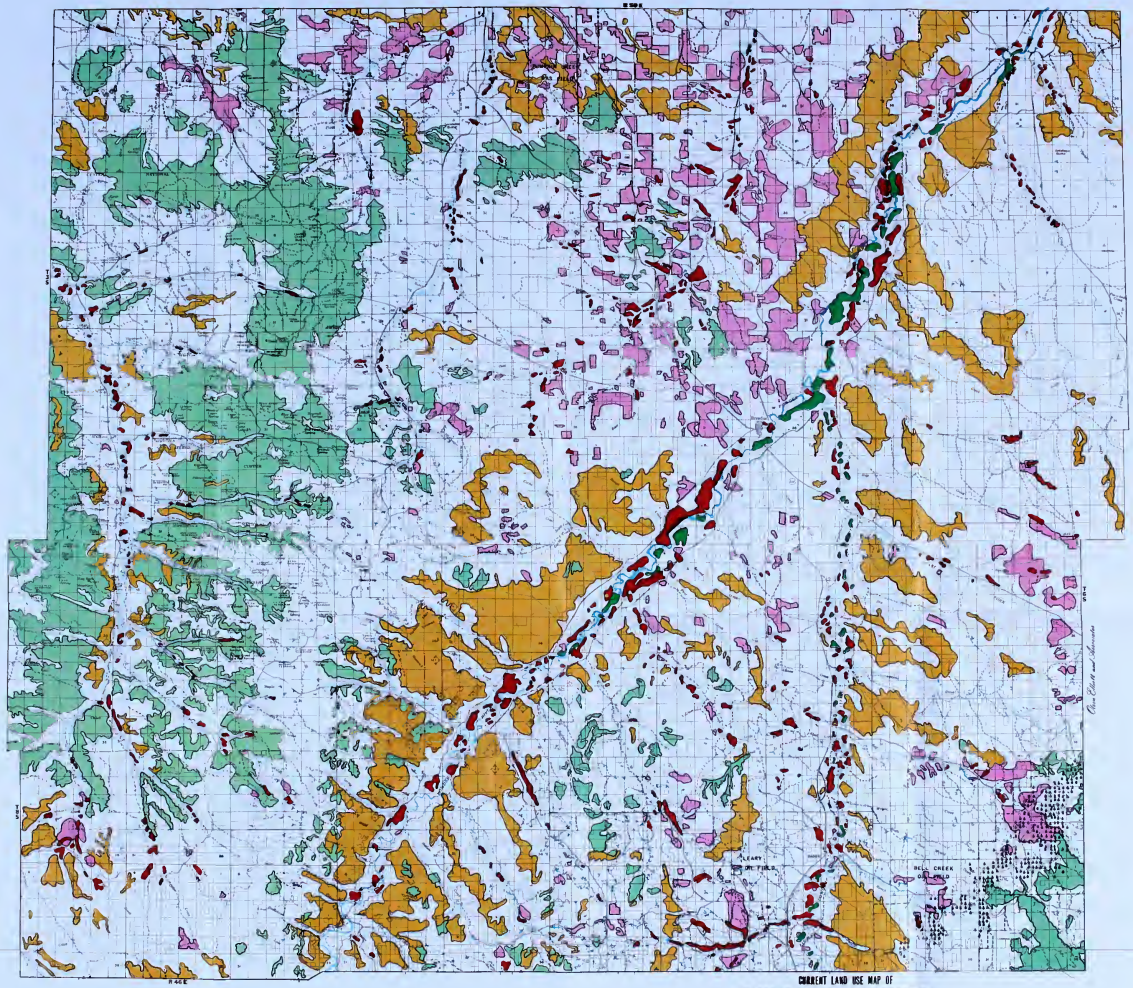
Road Ford		Oil wells		Ruins Small Large	Ruins Ruins	Well	
Trail Ford		US Mineral or Location Monument		Cemetery	CEM	Artesian Well	
Road Tunnel		Located Object (Labeled)		Sawmill		Windmill	
Railroad Tunnel		Triangulation Station	Dog	Airfield		Aqueduct Tunnel	
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

Data sources for the Current Land Use Map include the following:

Base Maps - Bureau of Land Management Surface Management Quads (1974, 1975);
Boxelder Recreation Map; Montana Dept of Highways (1972)

Data Sources - Skylab Photography; 1973 Landsat Imagery (April, 1976);
U.S.G.S Aerial Photography (1972); B.L.M. Planning Unit Data (1975);
Montana Dept of Natural Resources and Conservation Irrigation maps (1970);
Soil Conservation District and Current Land Use Data (1969 to current);
Other Montana State Agencies



CURRENT LAND USE MAP OF

POWDER RIVER COUNTY, MONTANA

Yellowstone-Tongue A P O
Broadus, Montana

miles

Deciduous Forest
Coniferous Forest
Rangeland
Mixed Range (Rangeland)
Nonirrigated Cropland
Irrigated Cropland
Urban
Surface hydrological features

The Yellowstone-Tongue Area Wide Planning Organization is the vehicle for a Water Quality Project that includes Carter, Custer, Fallon, Powder River, Rosebud, and Treasure Counties and the Northern Cheyenne Indian Reservation

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Broadus, Montana 59317
406 436-2802 or 406 436 2816

To

POSTAL PATRON
LOCAL

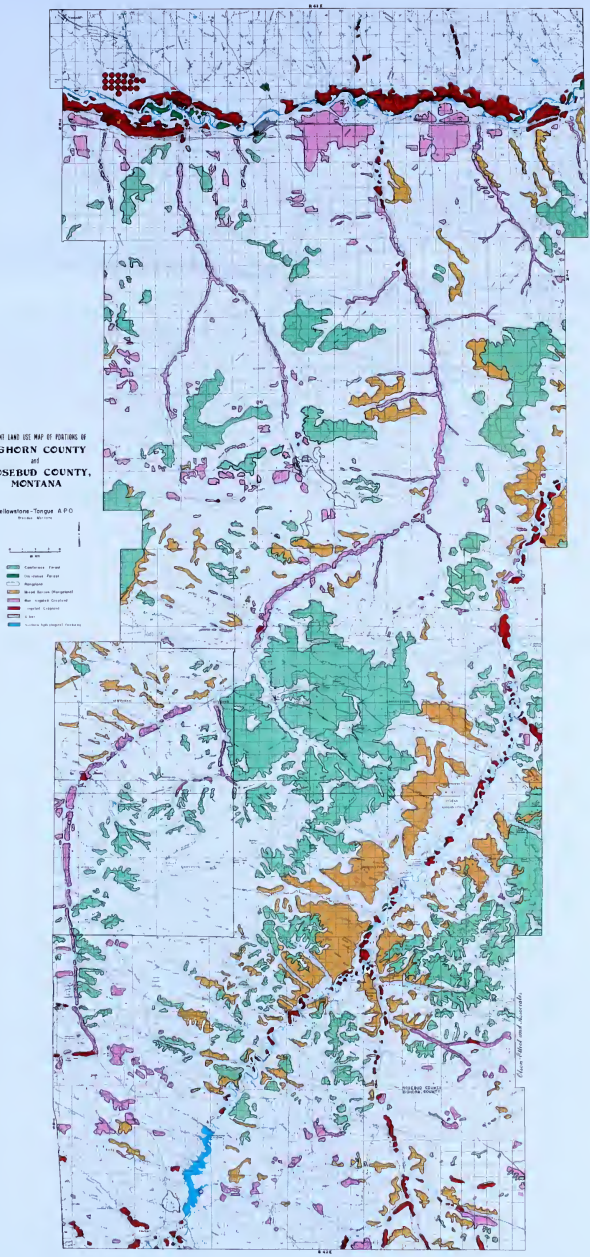
MAP SYMBOLS

Feature	Symbol	Feature	Symbol	Feature	Symbol	Feature	Symbol
Road All Weather	Divided	Principal Access	Divided	Buildings		Towns and Cities	
Road Seasonal Use		Solid waste dump	W	Buildings (Abandoned)		River or Large Stream	
Road "Jeep" Type "Primative"		Road Interchange		BLM Office		Stream	
Trail		Rest Area		School		Large Dam	
Railroad Double Track		Sand or gravel quarry		Church		Reservoir or Retention Dam	
Railroad Single Track		Scoria mine Bentonite mine		Radio Installation		Lake or Pond	
Glacier		Levee or Dike		Fire Lookout (Primary)		Intermittent Lake or Pond	
Road Bridge		Corral		Fire Lookout (Secondary)		Dry Lake or Pond	
Railroad Bridge		Recreation Site		Fire Tool Cache		Marsh	
Foot Bridge		Tanks-(label as to type)		Shelter		Spring	
Ferry		Gas wells		Cliff Dwelling		Improved Spring	
Road Ford		Oil wells		Ruins Small Large	Ruins Ruins	Well	
Trail Ford		US Mineral or Location Monument		Cemetery	CEM	Artesian Well	
Road Tunnel		Located Object (Labeled)		Sawmill		Windmill	
Railroad Tunnel		Triangulation Station	Dag	Airfield		Aqueduct Tunnel	
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

[illegible] of the Current Land Use Map include the following:

Base Map: Bureau of Land Management Surface Management Quads (1974 [illegible])
Boreilar Recreation Map: [illegible] Highway (1[illegible])

Data Sources: Skylab Photography; 1973 Landsat Imagery (April 1976)
U.S.G.S. Aerial Photography (1972), B.L.M. Planning [illegible]
Montana Dept. of Natural Resources and Conservation [illegible]
Soil Conservation District and Current Land Use Data [illegible]
Other Montana State Agencies


CURRENT LAND USE MAP OF PORTIONS OF
BIGHORN COUNTY
and
ROSEBUD COUNTY,
MONTANA
Yellowstone-Tongue A.P.O.
Forest Service
Cultivated - Forest
Cultivated - Pasture
Rangeland
Mined Barren (Rangeland)
Non-irrigated Cultivated
Irrigated Cultivated
Lake
Yellowstone Hydroelectric Reservoir
ROSEBUD COUNTY
BIGHORN COUNTY
Flora, Wildlife and Materials

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Broadus Montana 59317
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To

POSTAL PATRON
LOCAL

MAP SYMBOLS

Feature	Symbol	Feature	Symbol	Feature	Symbol	Feature	Symbol
Road All Weather	Divided	Principal Access	Divided	Buildings		Towns and Cities	
Road Seasonal Use		Solid waste dump	W	Buildings (Abandoned)		River or Large Stream	
Road "Jeep" Type "Primative"		Road Interchange		BLM Office		Stream	
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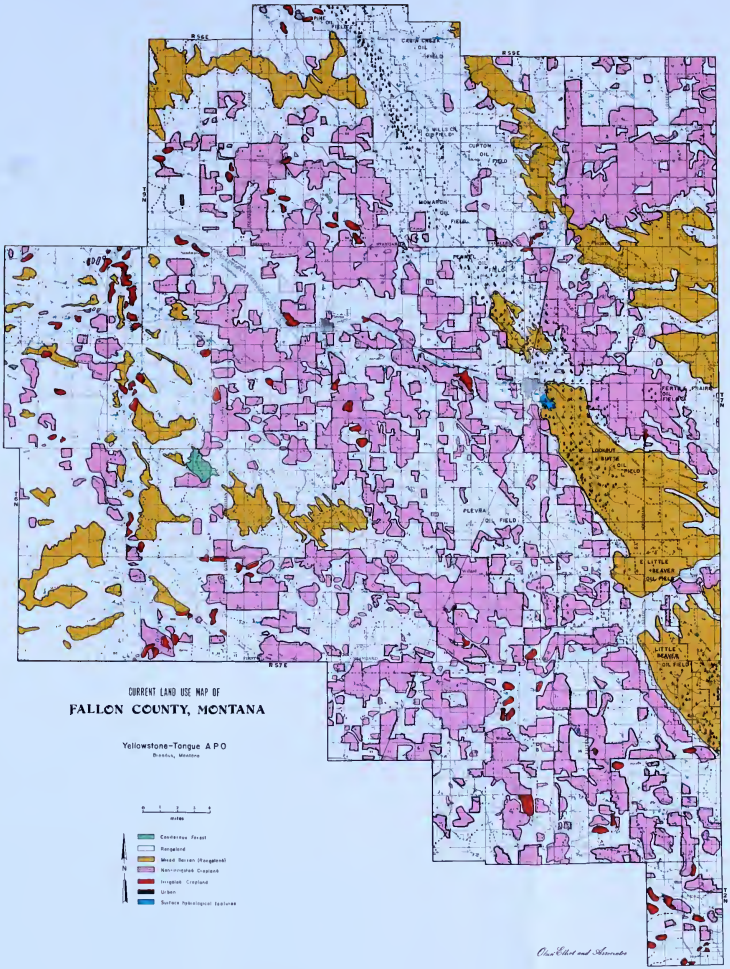
Railroad Double Track		Sand or gravel quarry		Church		Reservoir or Retention Dam	
Railroad Single Track		Scoria mine Bentonite mine		Radio Installation		Lake or Pond	
Glacier		Levee or Dike		Fire Lookout (Primary)		Intermittent Lake or Pond	
Road Bridge		Corral		Fire Lookout (Secondary)		Dry Lake or Pond	
Railroad Bridge		Recreation Site		Fire Tool Cache		Marsh	
Foot Bridge		Tanks-(label as to type)		Shelter		Spring	
Ferry		Gas wells		Cliff Dwelling		Improved Spring	
Road Ford		Oil wells		Ruins Small Large	Ruins Ruins	Well	
Trail Ford		US Mineral or Location Monument		Cemetery	CEM	Artesian Well	
Road Tunnel		Located Object (Labeled)		Sawmill		Windmill	
Railroad Tunnel		Triangulation Station	Dog	Airfield		Aqueduct Tunnel	
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	



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WATER QUALITY MANAGEMENT PROJECT

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POSTAL PATRON
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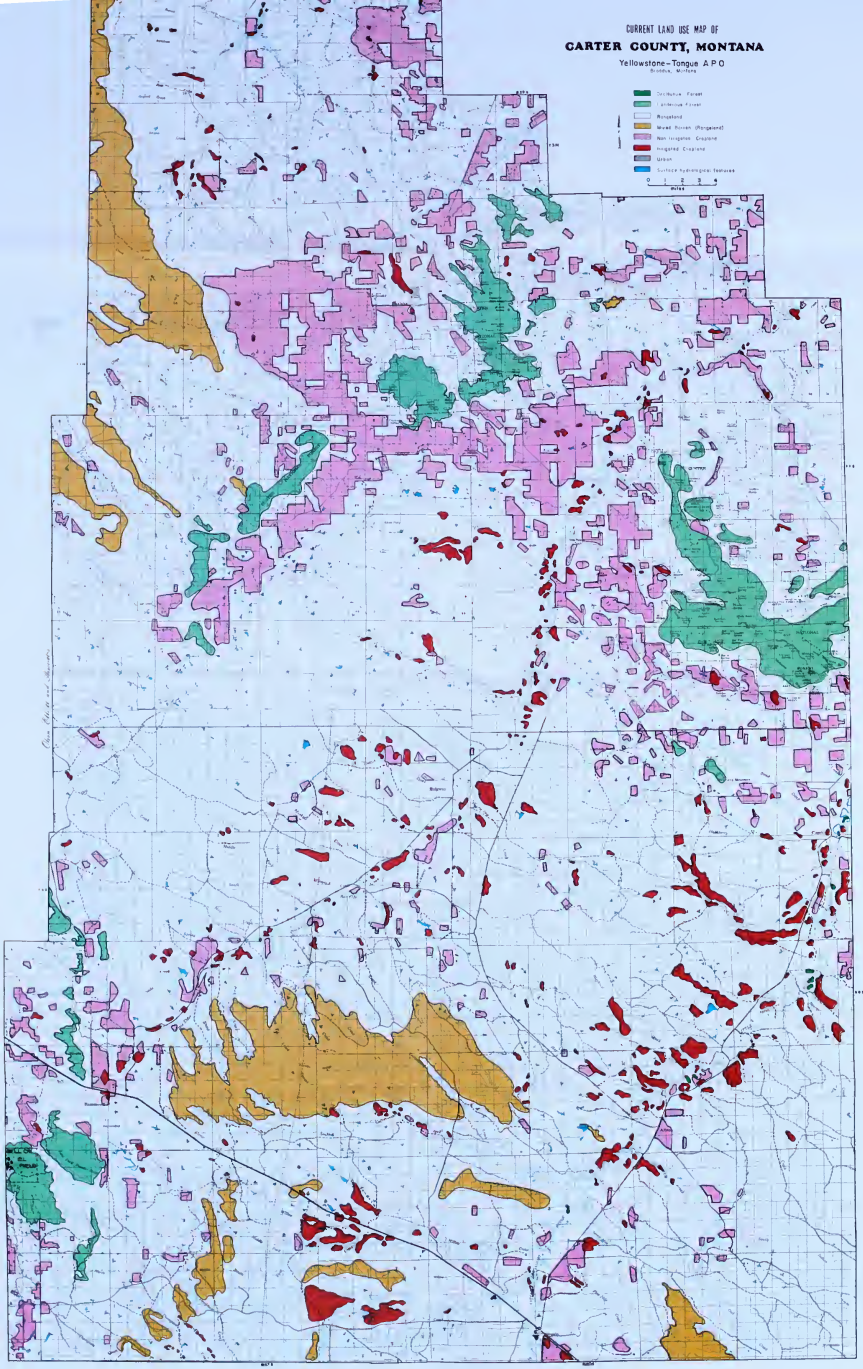
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

[illegible] for the Current Land Use Map include the following:

Base Maps - Bureau of Land Management [illegible] Management Quads [illegible]
Baseline Area [illegible] Map [illegible]

Data [illegible] Areas - Skylab Photography, 1971 Landsat Imagery [illegible]
U.S.G.S. Aerial Photography (1974) & [illegible] Planning Unit Lists (1975)
Montana Dept. of Natural Resources and Conservation Irrigation Maps (1975)
Soil Conservation District and Current Land Use Data (1964 to current)
Other Montana State Agencies


CURRENT LAND USE MAP OF
CARTER COUNTY, MONTANA
Yellowstone-Tongue A P O
Broadus, Montana
Ponderosa Forest
Lodgepole Forest
Rangeland
Wood Rocks (Rangeland)
Non Irrigated Cropland
Irrigated Cropland
Urban
Surface Hydrologic Features
1 2 3 4
MILES
Broadus
Ekalaka
Alzada
Camp Crook
Bear Creek
Ft. Meade
Ft. Meade Cem.
Ft. Meade Ch.
Ft. Meade Sch.
Ft. Meade Ch.
Ft. Meade Sch.
Ft. Meade Cem

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Broadus Montana 59317
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To

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LOCAL

MAP SYMBOLS

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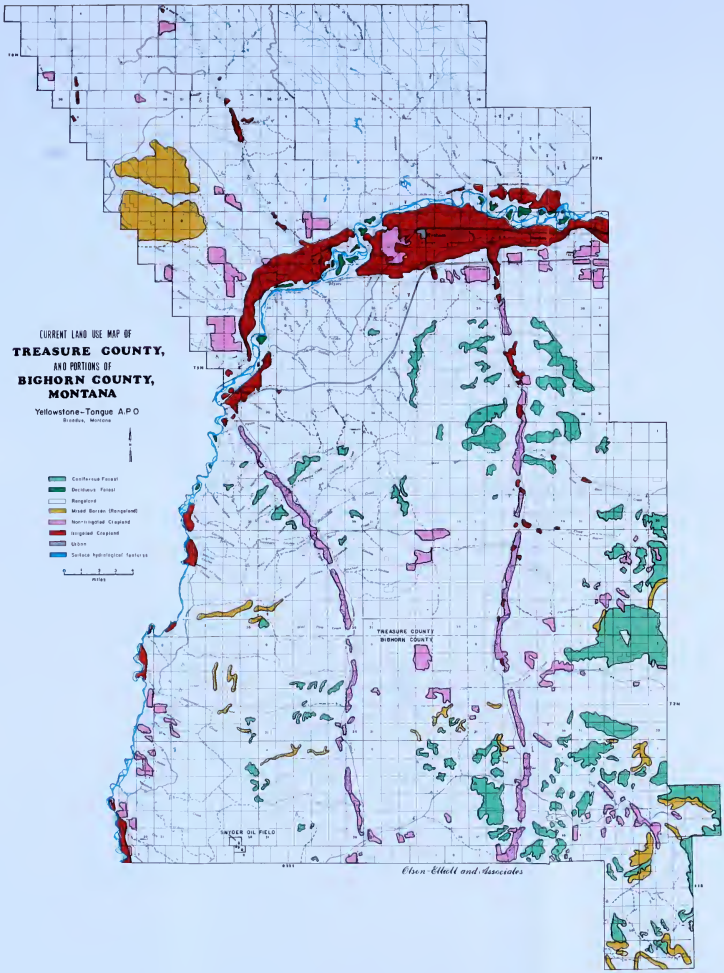
Coal mine		Bluffs or Cliffs				Ditch or Canal	
Prominent Peak		Prominent Ridge		Gaging Station		Aqueduct	

[illegible]

[illegible] Bureau of Land Management [illegible] Forest Service [illegible]
[illegible] Montana Dept. of Highways [illegible]

[illegible] Aerial Photography 1977 [illegible] Imagery (April [illegible]
[illegible] Aerial Photograph [illegible]
Montana Dept. of Natural Resources and Conservation [illegible]
[illegible] Conservation Districts and [illegible] Water Data [illegible]
[illegible] Montana State Agencies


CURRENT LAND USE MAP OF
TREASURE COUNTY,
AND PORTIONS OF
BIGHORN COUNTY,
MONTANA
Yellowstone-Tongue A.P.O.
Broadus, Montana
Coniferous Forest
Deciduous Forest
Rangeland
Mixed Barren (Rangeland)
Non-irrigated Cropland
Irrigated Cropland
Water
Surface hydrological features
miles
TREASURE COUNTY
BIGHORN COUNTY
SNYDER OIL FIELD
Olson Elliott and Associates